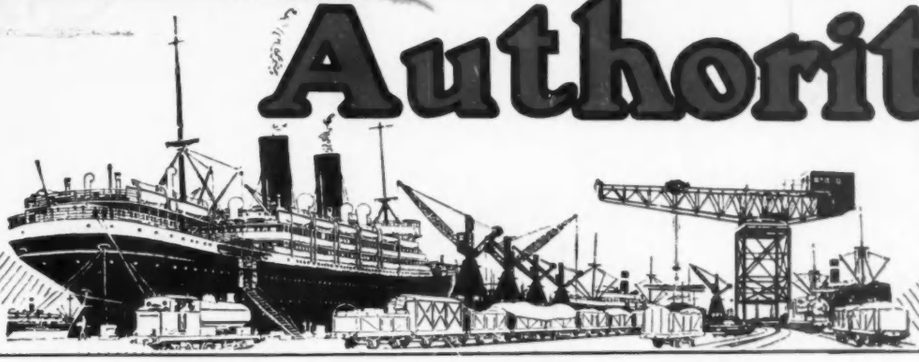
The Dock & Harbour Authority



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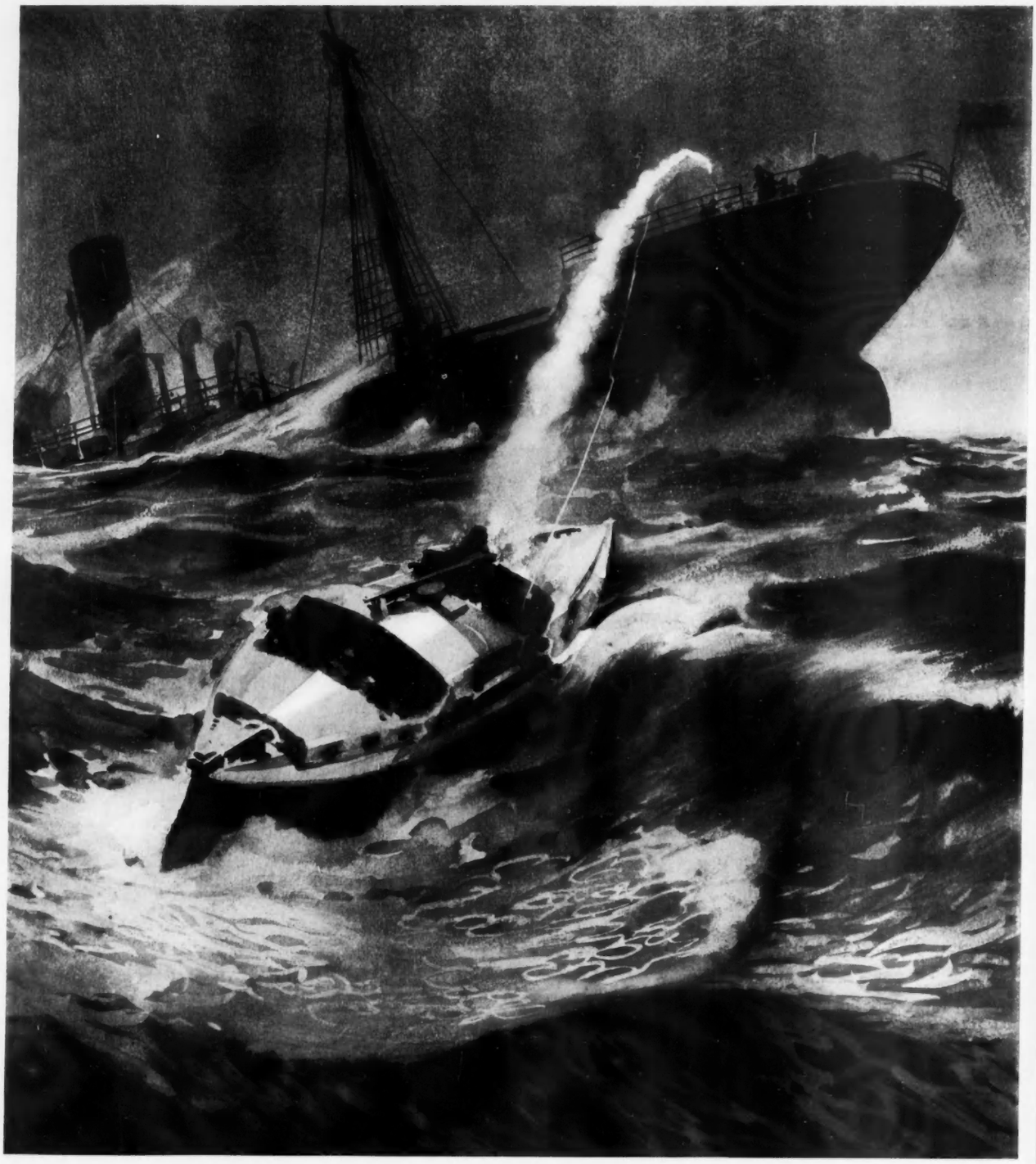
The Dock and Harbour Authority

INDEX TO VOLUME XXII.

Nos. 253 to 258, November, 1941 to April, 1942



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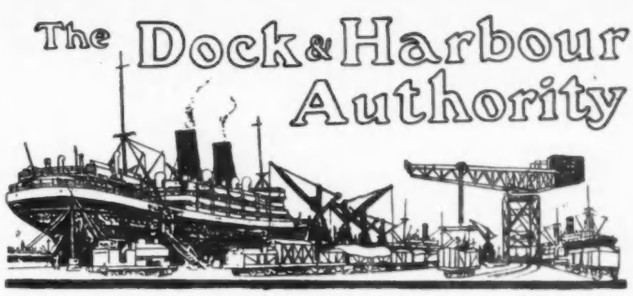


CONTENTS

N. A.

The Dock and Harbour Authority

No. 253. Vol. XXII. Edited by BRYSSON CUNNINGHAM, D.Sc., B.E., F.R.S.E., M.Inst.C.E. NOVEMBER, 1941

Editorial Comments

Twenty-second Volume.

The November issue marks the commencement of a fresh volume of this Journal and the passing of another milestone in its career. This is but a trite remark to make, and is substantially what was said twelve months ago at the initiation of the previous volume; yet, on the present occasion it is fraught with special significance, for while there is implicit a sense of thankfulness and relief at having overcome numerous difficulties which have encumbered the progress of the Journal during the past twelve months, it cannot but be felt that even greater and more serious difficulties lie ahead. The outlook, indeed, has become darker and the prospect less encouraging.

In view of the general experience of rationing, it is unnecessary to remind our readers of the problems with which the management of the Journal is confronted in consequence of the reduction in the quotas for paper, the effect of which will be seen in the regrettable, but imperative, compression in this and future issues, nor can they be ignorant of the increasingly stringent regulations regarding the publication of matter capable of being useful to the enemy in the slightest degree. These are formidable handicaps, and the Israelites who were condemned by their Egyptian taskmasters to make the same " tale " of bricks without the official supply of straw were scarcely in a worse plight. Still, the burden is one which is shared by other publications, though it can be urged in the present case that the second restriction acts with double deterrent effect on a Journal which exists essentially to give information about British ports, often of a character likely to be particularly acceptable to the enemy.

However, we cheerfully and gladly admit that there are compensating factors. We acknowledge with sincere gratitude the sympathetic support and co-operation which we have received from subscribers and advertisers, as well as from our contributors, and we have every confidence that with their continued assistance and goodwill, the Journal will be able to maintain the same standard of quality and efficiency as that which has proved acceptable in the past. Such, at any rate, our readers may rest assured, will be our constant aim and endeavour.

Ceuta and Tetuan.

The attention of our readers is directed in the leading article this month to the twin ports, Ceuta and Tetuan, at the western entrance to the Mediterranean, which, though of minor commercial importance at the present time, may, in the future, by reason of their strategical situation, acquire considerable significance in the development of that country of great potentialities, Morocco. Morocco, a vast and rather ill-defined region at the extreme north-west corner of the African Continent, is, as yet, only partially civilised and contains within its borders strange mixtures and contrasts in races, religions, customs and language. Formerly the habitat of nomad tribes of Berbers, Rifis, Moors and Arabs, it has gradually been colonised by Spaniards, French, Jews and Italians, immigrants from the Northern and Eastern shores of the Mediterranean. The result has been a more or less thin veneer of civilisation, mainly spread along the coastal front, overlying a deep, almost impenetrable, layer of barbarism. Side by side with the most modern features of European culture and refinement are to be found traces of savagery and despotism. There are broad, well-lighted streets, noble buildings and spacious avenues; there are also dark and squalid alleys in which native prejudices and traditions still hold undisputed sway.

The ancient quarters of Ceuta and Tetuan unmistakably retain their atmosphere of mystery and intrigue. In the narrow winding streets fronted by small lock-up booths or shops, often little larger than packing cases, in which native craftsmen ply their trades and sell their wares, swarthy men enveloped in burnous and enigmatically-eyed women veiled in their yashmaks, steal silently among the shadows. In the poorer districts comestibles are exposed for sale in an environment thoroughly repugnant to modern ideas of sanitation, where noxious smells exhaled from foul garbage and ill-drained gutters, together with dust and innumerable flies, all excite in the European visitor a sense of disgust and fear of infection.

The better class shops and emporiums deal, of course, in superior goods on modern lines. Much custom, however, is done at open booths, and we recall an impression, typical of Oriental habitudes, made in a scene in one of the streets of Tetuan some few years ago. The party to which we were attached, shepherded by a guide from whom we were warned, with somewhat sinister advice, not to get separated, was wending its way through the native quarters, when some members lagged behind to effect a bargain with a vendor of fancy articles. On observing this, the guide at the head of the procession, with a profound disregard for any legal considerations about libel or slander (if such matters, indeed, have any force in Morocco), vociferated at the top of his voice in broken English: " Don't buy from that man; he cheat you; he rob you! Come with me; I show you where you get good things, ver' cheap." It can be surmised, of course, that the guide was pecuniarily interested and no doubt, received a commission on custom which he attracted to the shops of his friends—hence his resentment of other and, in his eyes, irregular dealings.

There is a strong suspicion that much of the fine brasswork and leather ware on sale in Moroccan ports has it origin in Birmingham and the English Midlands, being exported to Morocco in order to be foisted on unsuspecting tourists. In any case, quite a brisk trade is carried on during the season both in shops and at the quayside, where itinerant vendors proffer their goods at extremely erratic prices bearing little relation to the actual value of the articles. The customary procedure is for the vendor, at the outset, to ask about twice as much as he is prepared to accept, and for the potential customer (if he " knows the ropes ") to make an offer of about half of what he is disposed to give. Thereupon ensues much chaffering; by degrees the gap is narrowed and, perhaps ultimately, the article is sold. Attractive bargains by the visitor are usually picked up at the last moment prior to departure, even when the ship is actually casting off from the quay. Anxious to dispose of as much as possible, the vendor, instead of the usual formula: " What you give ?" plaintively substitutes " What you got? " indicating that he is prepared to accept almost anything the visitor may have left in his purse.

These two Moroccan ports are a strange and incongruous mixture of old and new, of East and West. The commodious harbour of Ceuta is frequented by large and stately up-to-date liners, which are berthed, or moored, behind substantial breakwaters of modern construction. In the background lies the age-old town, with its quaint and decrepit tenements, which have seen many vicissitudes and housed many generations.

Tetuan, though classed as a port, is lacking in many characteristic features of the type, being located some distance from the coast and, indeed, deriving its importance more from political than commercial considerations. It is the capital of the province, the seat of the native government and contains the official residence of the Sultan.

Editorial Comments—*continued*

Port Labour.

With the nomination of the directorate for the new National Dock Labour Corporation and the issue by the Ministry of Labour and National Service of an Essential Work Order (particulars of which will be found elsewhere in this issue), combined with the outline of a Model Dock Labour Scheme, the efforts of the Government to provide a systematised service of cargo-handling labour at British ports may be said to have reached a definite conclusion. All that now remains to be done is to watch the progress made by the new body and ascertain in what respects the machinery needs to be amended or improved, for it is hardly likely that a brand new organisation on totally new lines and departing from all precedent, however carefully designed, can escape a certain number of " growing pains." At any rate, whatever the result, and there is every reason to believe that it will prove satisfactory in the great majority of cases, the scheme is a bold and courageous attempt to remove the defects inherent in the former system, or lack of system, which prevailed so long in the management and control of port labour. The Government are entitled to congratulate themselves on a notable step forward in the direction of making dock labour more efficient and the men more contented with their jobs.

It is too early yet to feel that the problem of " decasualisation " has been entirely solved. So many attempts have been made in the past to grapple with it, that there must be some hesitation in pronouncing a verdict until the new system of organised enrolment and guaranteed pay has been thoroughly tested, for already some few abuses and irregularities have manifested themselves. Much depends on the spirit in which dockers and employers alike accept the new regulations. Cordial good wishes, however, will attend the inauguration of the new régime, which has been brought into existence at the most momentous crisis in the nation's history when every effort must be made to expedite the handling of ships and their freights.

Sir Arthur Sutherland, chairman of the Tyne Improvement Commission, has publicly given the scheme his commendation and reports from the North-east Coast indicate that in that locality there is general approval. At the same time, the existence cannot be overlooked of certain recalcitrant minorities among the men, who are not above making capital out of war-time emergencies in order to drive a hard bargain, and who place their own selfish interest above the national security. These men will have to be dealt with firmly; otherwise, there is a danger that the scheme may be wrecked or seriously impaired.

Proposed Alteration to Manhattan Front, New York.

A proposition has been submitted to the Port of New York Authority for an alteration to the frontage at the southern tip of Manhattan Island by the construction of a new bulkhead in front of Battery Park, extending 60 feet in advance of the existing open pile wharf, and to the same extent channelward of the authorised Pierhead Line. The object of the proposed work is to " provide new land to replace that part of Battery Park to be used as approaches to the new vehicular tunnels under the East River and Buttermilk Channels." As the proposed filling will affect the tidal flow in this part of the harbour, opposition to the scheme has been manifested. The matter is under consideration by the United States Army Chief of Engineers in Washington.

Battery Park, with its aquarium, is a familiar sight to all visitors to the port of New York. It lies at the extreme end of Manhattan Island and is fronted by a bulkhead wall with an open pile wharf. From a navigational point of view, this is a very exposed position, and it is reported to be one of the worst places in the harbour for accidents to craft. Partly this is due to the great volume of excursion traffic which starts from the vicinity of the Battery, and during the summer months is very heavy. It is stated that on Sundays and holidays at least 20,000 passengers board steamers from the Battery.

The encroachment on the narrow and highly congested waterway between Governor's Island and the Battery is, therefore, a matter for serious consideration, as also is the reduction in free flow for the tidal stream. The Port Authority, however, take a favourable view of the proposal, being of opinion that it may be helpful in reducing the number of accidents, but, at the same time, they make the reservation that the extent of rock filling under the new wharf alignment should " be limited, if necessary, so that there will be no adverse effects on tidal currents in this vicinity passing between the Hudson and East Rivers and *vice versa*."

The question of tidal obstruction is so important that it has been suggested that the design of the proposed bulkhead should form the subject of model tests by the United States Waterways Experimental Station at Vicksburg, Miss., and this course will probably be adopted before official sanction is given to the project.

Presidential Addresses.

At this season of the year, learned and scientific societies and associations are accustomed to inaugurate their autumn and winter sessions with the delivery of an annual Presidential Address. These addresses are both numerous and varied: indeed, having regard to the lengthy records of most British technical and other institutions, it is a matter for wonder how each successive incoming president finds material for an original discourse, which does not traverse ground already covered by his predecessors. Generally, he devotes himself more or less to a survey of institutional domestic affairs for the earlier part of his address, subsequently making some *ex-cathedra* utterances on certain features of professional work which have come within the range of his particular experience.

Out of the considerable volume of recent presidential oratory we can only select two addresses for mention, since the others steer fairly wide of the purview of this Journal.

The Institute of Transport is a body which should be particularly interested in matters affecting port operation, though it must be confessed that its outlook is more often directed to the conveyance of goods and passengers by rail and road than by sea and through ports. The President for the current year, Mr. J. S. Nicholl, being actively associated with road transport, it was natural for him to give that branch of transport his main, if not his exclusive, consideration. He had a number of interesting and illuminating points to make on the present situation of road affairs and their future outcome, which will abundantly repay reflection, but he did not touch, probably from lack of time, on the part played by cartage and haulage in connection with port work, nor on the novel and interesting experiment in the pooling of cartage resources for quayside work at the port of Liverpool, upon which we hope to have something to say in a future issue, when giving an account of the scope of operations of the recently formed body known as the Port of Liverpool Road Transport Control, Ltd.

The address of Mr. Fred C. Stewart to the Institution of Engineers and Shipbuilders in Scotland was on the topic of the Compass and Other Aids to Navigation, some of which are applicable to manœuvring in harbour waters. He mentioned modern methods of sounding, including echo-sounding, on which there have been several articles appearing in this Journal; also he referred to Tidal Prediction and Fixed Signals for navigation in the vicinity of ports. His address, however, was too condensed and discursive for detailed review, being described by himself as merely a brief survey to enable his listeners " to realise the immense amount of hard and valuable work which has been done in the service of the navigator." This they could hardly fail to do.

The Oil Port at Lake Charles.

The impending completion of the new Calcasieu Ship Channel, leading from the Gulf of Mexico to the important oil port of Lake Charles, distant 50 miles inland in the State of Louisiana, U.S.A., is evidenced by the steps now being taken by the United States Coast Guard to provide the channel with buoys, lights and other aids to navigation. These comprise 42 automatic lights, nearly 100 unlighted beacons and about 15 lighted and unlighted buoys.

A description of the port and its activities was given in the issue of this Journal for April, 1938. It was therein stated that the port, which is one of the few in the United States constructed and financed entirely by local funds, was opened to traffic in November, 1926, so that it is of quite recent origin. Since that date, it has developed rapidly, and it is now one of the most important oil ports of Western Louisiana.

The principal obstacle to its development was the tortuous and inadequate approach by water from the Gulf of Mexico. Leaving Lake Charles, the ship channel, with a depth of 25 feet and a minimum bottom width of 125 feet, followed the River Calcasieu for a short distance south, until it intersected and entered the Intracoastal Canal, which runs in a straight line for 21 miles. It then joined the Sabine River below the port of Orange, Texas, and entered the Gulf of Mexico through the Sabine Pass. The distance from Lake Charles to the Gulf by this route is 75 miles.

The new Calcasieu Channel reduces the distance by nearly one-half; it leads northward from Calcasieu Bay in a straight reach of five miles, and then, after a slight bend, follows another straight course for 36 miles. The termination of the second reach is at Devil's Elbow on the Calcasieu River, which is followed thereafter to Lake Charles. The channel has a depth of 32 feet with a width of 400 feet for the first five miles, and a depth of 30 feet with a width of 250 feet for the remaining distance to the river, in which there exists at present a controlling depth of 30 feet.

The enterprise, which is due to the courage and initiative of the citizens of Lake Charles, is highly commendable, and they will, it is to be hoped, reap considerable benefit in the way of increased traffic. The latest returns are not at hand, but in 1936 over 470 ocean-going ships visited the port via the old channel, and the cargo handled amounted to 2,866,255 tons, valued at $34,782,037. There is every reason to expect an appreciable increase in these figures when the new route is available.

The Ports of Ceuta and Tetuan

Twin Ports in Spanish Morocco

Location

AT the Western entrance of the Mediterranean Sea, on the projecting strip of territory at the north-western corner of the African Continent, immediately opposite Gibraltar, stands a group of three ports: one facing the Atlantic Ocean and the other two just inside the Mediterranean Basin. Of these, the first and most important, Tangier, has already received descriptive notice in this Journal in the issue of July, 1937. In the present article, it is proposed to give some account of the other two—Ceuta and Tetuan—which lie in close proximity to one another and may appropriately be described as twin ports, having several features and interests in common.

The region in which all three ports are situated is a part of the extensive, but ill-defined, country of Morocco, which covers roughly some 200,000 square miles, rather more than less; some reference books give it as much as 230,000 square miles. With Algeria and Tunisia, it forms one large geographical unit, the Djezira-el-Maghreb—the Isle of the West of mediæval Arab geographers and the Barbary of their European contemporaries. Formerly, and still superficially, governed by chiefs and sheiks of the native Berbers and Moors, under the Sultan of Morocco, the suzerainty of the country has definitely passed into the hands of France and Spain, the former possessing by far the larger share. The relatively small strip of North African Coast, some 13,000 square miles in extent, opposite the south of the Iberian Peninsula, constitutes the Spanish Protectorate, comprising a series of small Presidios, including those of Ceuta, Tetuan and Melilla. Tangier, as has been explained in a previous article, has been internationalised under a Convention signed in 1923 by Great Britain, Spain and France and later by Italy. It is to be observed, however, that Spain has lately usurped certain administrative functions in the zone in a manner inconsistent with the terms of the agreement, and this action has led to diplomatic protest by Great Britain.

PORT OF CEUTA

Ceuta is entitled to prior attention as a more important port than Tetuan, though, as cities, both approximate to the same standard of size, with populations in the neighbourhood of 50,000. But Ceuta is actually located on the sea coast, with a harbour on its immediate frontage, whereas Tetuan lies several miles inland and has no sea or important river frontage, its trade being carried through a little auxiliary port or annexe at the mouth of the stream, known as Rio Martil, or Martin.

Ceuta and Tetuan, however, are closely associated in trade matters and are linked by a narrow gauge railway, 40 kilometres (about 25 miles) in length.

Location and Environment

Confining attention at the moment to Ceuta, this port is located on the Bahia de Ceuta, which lies between two promontories, Punta Bermeja and Punta de Santa Catalina, which are about three miles apart. Within the embayment between them, there is an artificial harbour formed by two stone breakwaters, or "Diques," enclosing an irregular area of roughly 200 acres, or thereabouts. The eastern breakwater, or Dique de Levante, is straight in line, extending in a westerly direction for a length of some 2,000 feet from the coast line at San Amaro. The west breakwater, or Dique de Poniente, is cuvilinear in plan, starting from a coastal projection near Punta Benitez and curving round for a length of about 5,000 feet in an easterly direction towards the Dique de Levante, terminating at a point which leaves an opening of 360 yards width between the two pierheads.

Harbour Accommodation

The artificial enclosure thus formed affords excellent shelter for shipping, and there is also moderate protection in the bay itself, which, however, is subject to fresh south-easterly winds, causing disturbed seas, while, with westerly winds, there are heavy squalls from the mountains.

Inside the harbour, there is a mole, or pier, projecting north-eastward from the western end of the town. This is the Muelle de Espana, or Spanish Mole, formerly called Meulle de la Republica. It has a frontage of 16,000 lin. feet on its east side and 1,100 feet on the west side. The width of the mole is 200 feet.

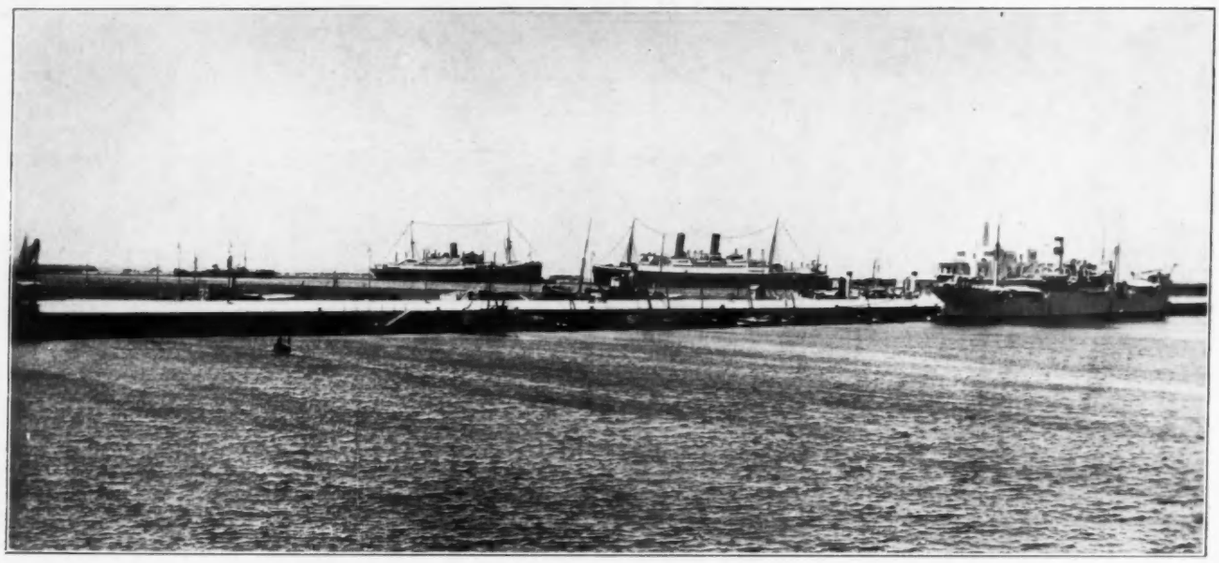
There is also a much shorter and smaller mole, the Muelle del Comerica, or Commercial Pier, practically parallel with the Muelle de Espana, at a distance therefrom of 400 yards to the East. It is very short, being only 400 feet in length.

Ceuta harbour is easy of access, and there is good anchorage for shipping in depths of water ranging from 4 to 9 or 10 fathoms. Alongside the Dique de Poniente, where the larger vessels are berthed, there are depths of 50 feet and over. The largest vessel which has visited the port up to the outbreak of the war was the *Roma*, with a tonnage of 32,583. The entrance of the harbour has a depth of 60 feet.

To the east of the harbour lies a promontory peninsula with a bold headland, the Montagne des Singes, having seven peaks

Street in Tetuan.

The Ports of Ceuta and Tetuan—continued



View of the Spanish Mole, Ceuta Harbour.

(probably the Seven Brothers of the Roman designation), of which the highest, the Monte del Hacho—the ancient Ablya, one of the Pillars of Hercules—rises 636 feet above sea level.

The town or city of Ceuta consists of two parts: the old town covering the low ground of the narrow isthmus, connecting the Monte del Hacho with the mainland, and the new town, built on the hillside forming the north and west faces of the peninsula. The port area extends along the whole frontage of the old town as far as the root of the Dique de Poniente.

Trade at the Port

The trade of Ceuta is largely with Spain and adjacent countries in the Mediterranean, but it is also a port of call for vessels voyaging further afield. Imports consist of sugar, flour and machinery. There are exports of fish, antimony, ores, hides, bones and cork. Being a port of call, supplies of coal and oil are available—about 3,500 tons of coal and about 10,000 tons of fuel oil are normally kept in stock. The Ybarolla Company have tanks of 33,000 tons capacity.

Coal is delivered to shipping by means of a floating elevator, with a working capacity of 300 tons per hour. Fuel oil is fed through a pipe-line to vessels lying alongside the Dique de Poniente at the rate of from 300 to 400 tons per hour. Fresh-water supplies are obtainable at the loading berths.

Fishery

Fishing is an industry carried on at the port. There is a tunny fishery ground on the Ensenada de la Almadraba, south of the Promontory, whence supplies are obtained for export.

Historical

Ceuta is a settlement of quite ancient origin. It occupies the site of the old Carthaginian, and subsequently Roman, colony, Ad Septem Fratres, hence called Septa by the Romans and Sebta by the Arabs. Subsequent to the Roman occupation, the town fell into the hands of the Vandals, and afterwards into those of the Byzantine Emperor, Justinian, who restored the fortifications in 535 A.D. Then in 618, it was captured by the Visigoths. It was the last stronghold in North Africa to hold out against the Arab invasion. Repeatedly taken in turn by rival Berber and Spanish-Moorish dynasties, at length, after years of doubtful conflict, it settled down in 1580 under Spanish dominion, having become an important industrial and commercial centre, noted for it brassware and general trade, which, at that time, included slaves.

During the eighteenth century it was several times unsuccessfully besieged by the Moors. In 1810 it was temporarily held by the English under General Fraser. At the present time, it is under direct Spanish rule, forming one of the judicial districts of the province of Cadiz and coming under the naval jurisdiction of Algeciras.

TETUAN

The position of Tetuan as a port is somewhat anomalous. As has already been stated, it is an inland town, and its chief importance lies in the fact that it is the capital of the Spanish zone. It is distant six miles by road from the sea, and the little suburb of Rio Martin, with its Custom House, constitutes its port

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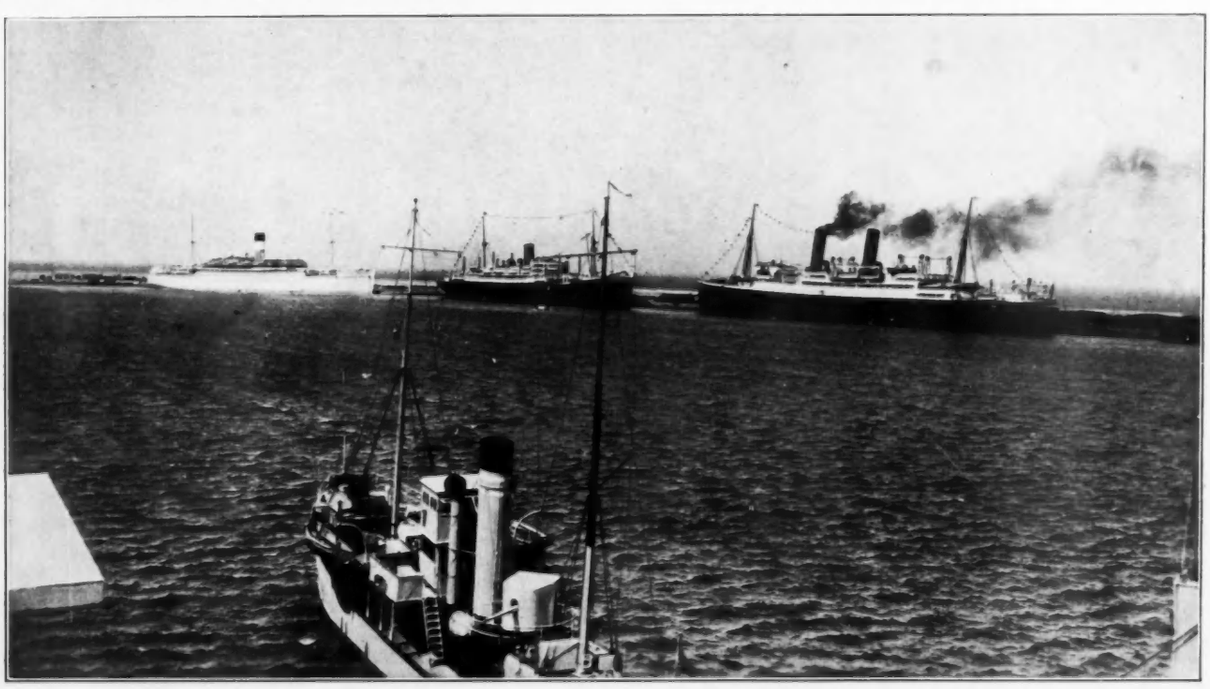
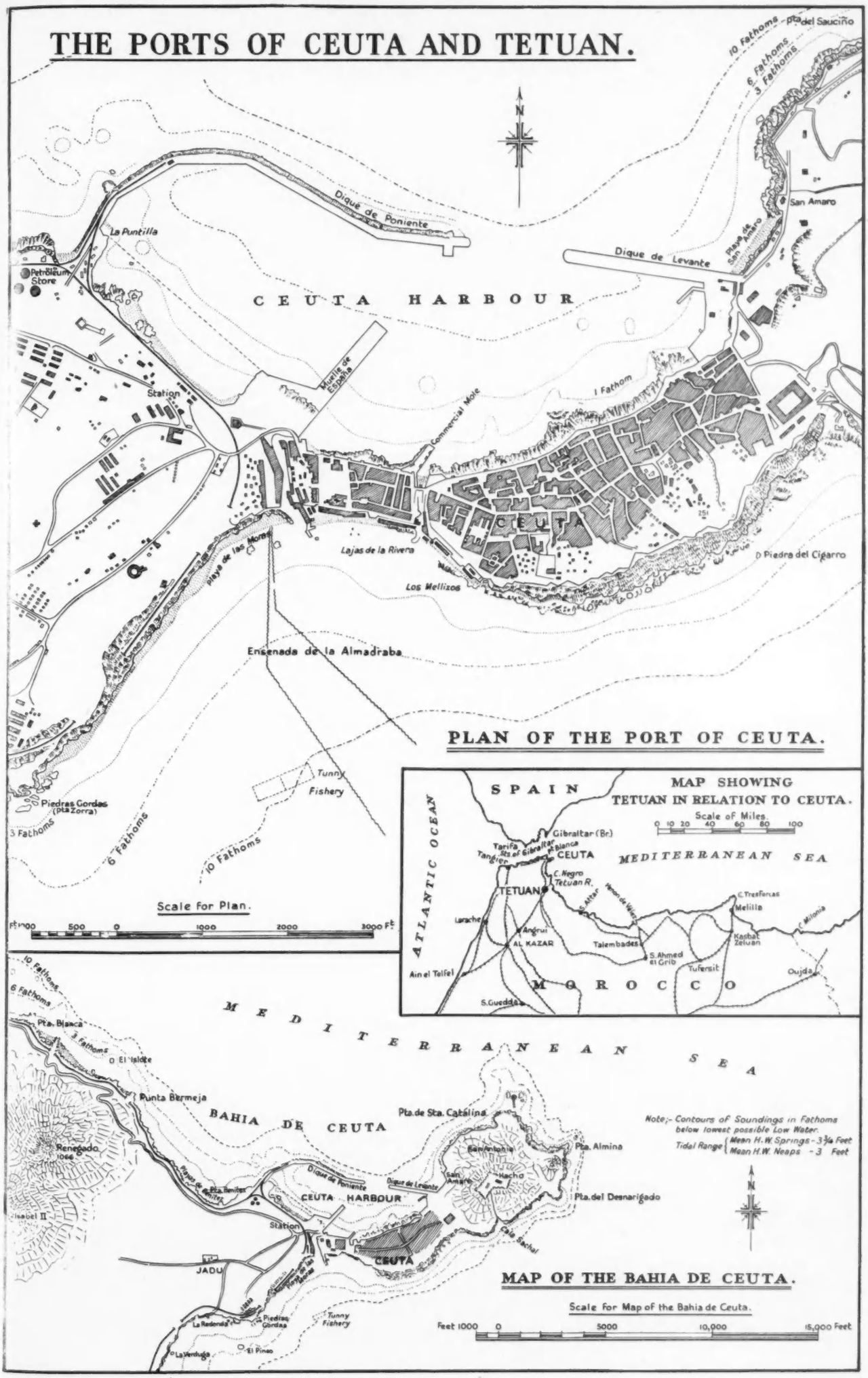


View of Ceuta Harbour from the Maritime Station (Spanish Mole).

THE PORTS OF CEUTA AND TETUAN.



PLAN OF THE PORT OF CEUTA.

MAP OF THE BAHIA DE CEUTA.

The St. Lawrence and Great Lakes Seaway

Formation of Deep-Water Channel in the Upper St. Lawrence

THE gigantic undertaking (known variously as the St. Lawrence Ship Channel and the Great Lakes Seaway), estimated to cost over 66 millions sterling, entered upon jointly by the Governments of the United States and the Dominion of Canada, is, as has been explained in previous issues of this Journal, a dual project for the exploitation of the great potentialities of electric power generation in the River St. Lawrence and, simultaneously, for the creation of a deep-water navigable channel, which will enable ocean-going vessels to penetrate into the North American Continent as far as the head of the Great Lakes.

Electric power supply is a matter outside the purview of this Journal, but the navigable development of the Upper St. Lawrence with its influence on the development of numerous ports in the interior of the Continent and the expansion of waterborne commerce is so important a feature, that some particulars of this aspect of the undertaking, additional to those already supplied are bound to be of interest.

With this article is reproduced a diagram* showing the nature and extent of the projected works, which will give a general idea of the scheme in so far as it concerns navigation in the River St. Lawrence. The deep waterway, it will be seen, is international, lying partly within the United States and partly in Canada with the boundary line of the two countries passing for a considerable distance along the central axis of the river.

The following particulars are given of the five sections into which the works are divided, viz.: the Lachine Section just above Montreal; the Soulanges Section; the Lake St. Francis Section; the International Rapids Section, and the Thousand Islands Section, which leads into Lake Ontario.

Downstream of Montreal there is ample depth in the river for vessels of 25 ft. draught, the standard adopted, for which a channel with 27 ft. of water is needed.

The Lachine Section

This section, 24 miles in length, extends from Montreal Harbour to the head of Lake St. Louis, and takes its name from the Lachine Rapids in the river, which are to be eliminated. The section will be dealt with under a scheme formulated in 1926, which contemplated a lateral navigation canal 10 miles in length with locks and control of the water level in Lake St. Louis. There will be channel deepening for five miles from Lachine to Lake St. Louis. The maximum difference in water level in the section is 53 ft., with an average of 48 ft. to be negotiated in three stages, a pair of guard gates being provided in addition to the normal set of lock gates. The river is to be dammed at the Isle aux Diables, raising the low water level in Lake St. Louis to the required elevation. A number of bridges for rail and road traffic will be required.

The Soulanges Section

This section comprises a length of 18 miles of river, which falls 83 ft. through a series of rapids. At present navigation is carried on through the Soulanges Canal on the north bank, while on the south side lies the power canal of the Beauharnois Light, Heat and Power Company, approximately 15 miles in length, extending from Valleyfield at the eastern end of Lake St. Francis to Beauharnois at the western end of Lake St. Louis. It is 3,200 ft. wide and has a control dam about four miles below Lake St. Francis. This deep waterway project involves the utilisation of this power canal for navigation, the Beauharnois Company being obliged, under agreement with the Canadian Government, to provide a dredged channel 600-ft. wide and 27-ft. deep adjacent to the north embankment.

The works included in this section comprise the excavation of an approach channel, 450 ft. wide, from deep water in Lake St. Francis to the power canal; the construction of a short lateral canal and guard lock at the control dam, and of a second lateral canal with guard gate and two twin locks between the power canal and Lake St. Louis. There is also entailed the replacement of two fixed bridges across the power canal by vertical lift bridges, with the construction of two additional bridges; a railway bridge over the guard gate and a road bridge over the lower entrance to the locks between the canal and Lake St. Louis.

The Lake St. Francis Section

This section of 26 miles running through the centre of Lake St. Francis from Valleyfield to St. Regis just below the town of Cornwall does not call for any special treatment.

*Reproduced from "Modern Transport" of May 24th, 1941.

International Rapids Section

Within this section, which is 47 miles in length, there will be works required in connection with two control dams and two sets of bye-pass locks with short lengths of lateral canal; one at Barnhart Island, where there will be two locks and the other at Iroquois Point, with a single lock. The locks are to have a depth of 30-ft. over sills and to be of the same general dimensions as the locks on the Welland Canal.

A certain amount of modification will be needed in the grading and alignment of railways and roads on both sides of the international boundary. Works must be undertaken to maintain the existing 14-ft. navigation on the Canadian side, around the control dam, and from the pool above the Long Sault Dam to the existing Cornwall Canal. The towns of Iroquois and Morrisburg are to be rehabilitated. All works in the pool below the control dam are to be designed for full Lake Ontario level, but, at first, the pool is to be operated at a maximum elevation of 238-ft. above datum.

It is specified in the international agreement that the Canadian Government undertakes to complete before the end of 1948, the all-Canadian links in the new waterway, including the deepening of the Welland Ship Canal from 25-ft. to 27-ft. and the construction of certain other canals and works to provide the necessary depth in the Canadian section of the St. Lawrence River. The agreement contains the important provision that "if the continuance of the war conditions or the requirements of defence justify a modification of the period within which such works shall be completed, the governments may, by exchange of notes, arrange to defer or expedite their completion as circumstances may require."

A permanent Great Lakes—St. Lawrence Commission is to be set up to administer the undertaking.

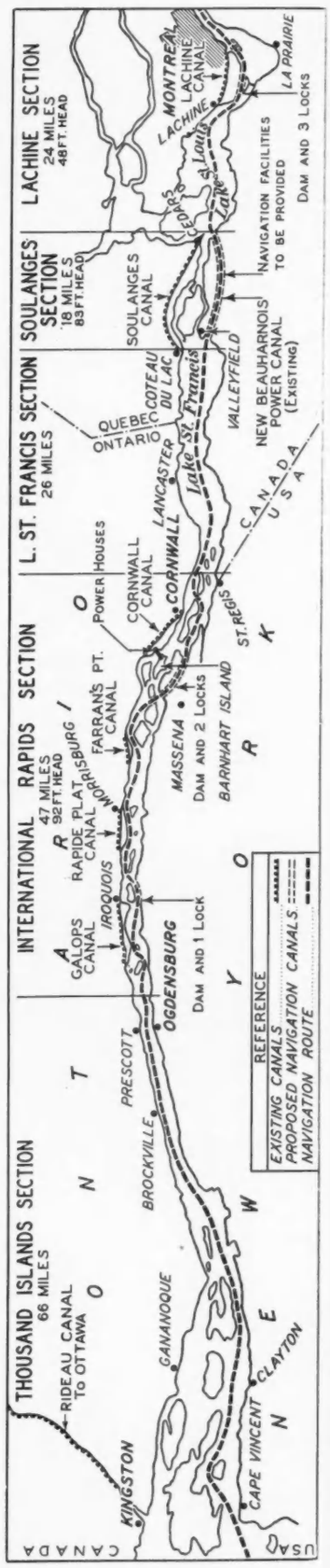
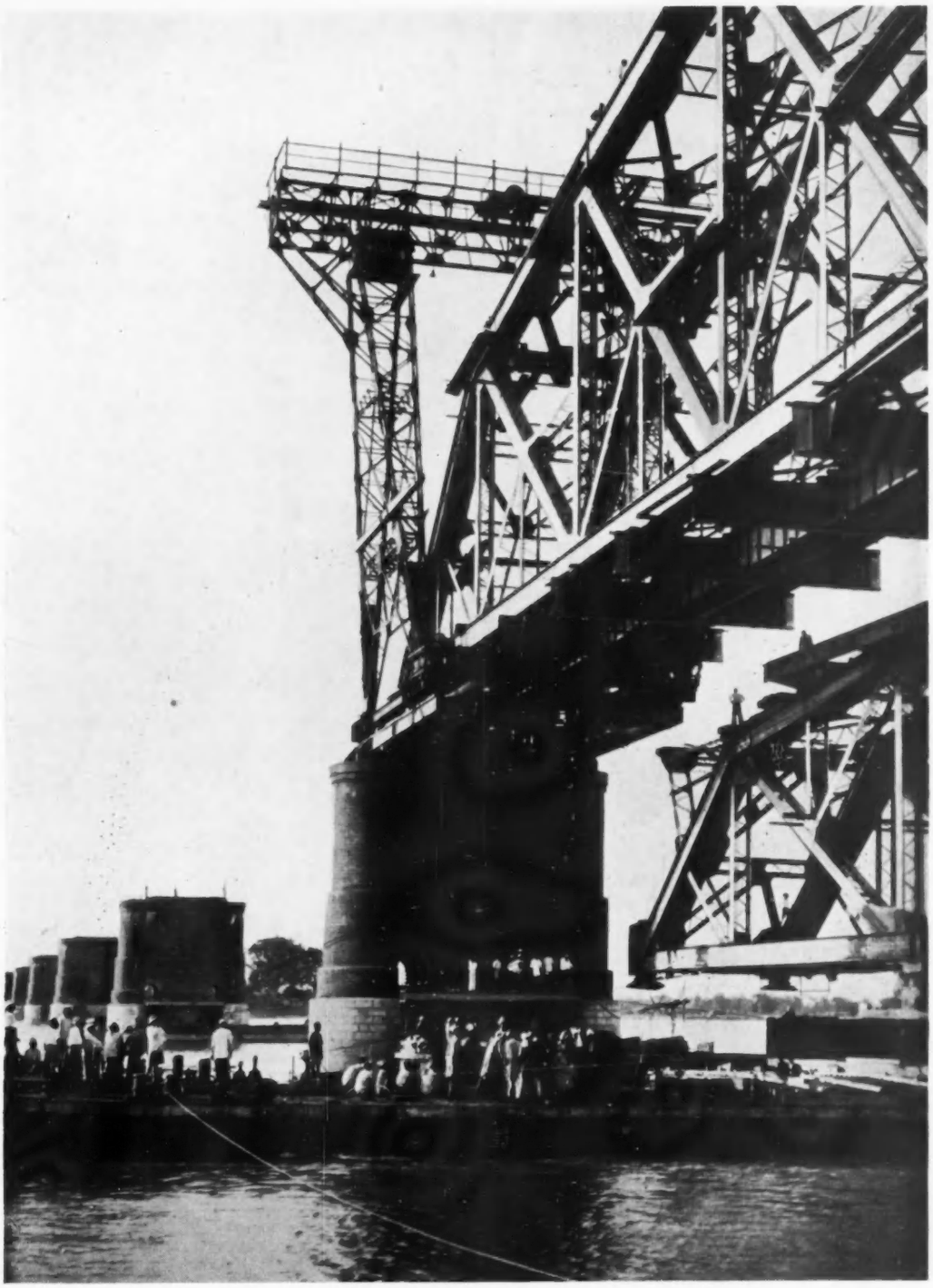


Diagram of the works involved in the projected St. Lawrence Seaway between Lake Ontario and Montreal.



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Waterside Flour and Grain Storage

*The Design of Flour Mills, Granaries, Warehouses and Silos**

By OSCAR FABER, O.B.E., D.C.L., D.Sc., M.Inst.C.E.

(Concluded from page 251)

FLOUR MILLS

Fig. 12 shows, on the right hand side building, a modern flour mill, which is described with the kind permission of the owners. The topmost portion of the building is the mill itself, and the lower portion is the warehouse. There are twelve floors in all, the lower five of which constitute the warehouse and the upper seven the mill.

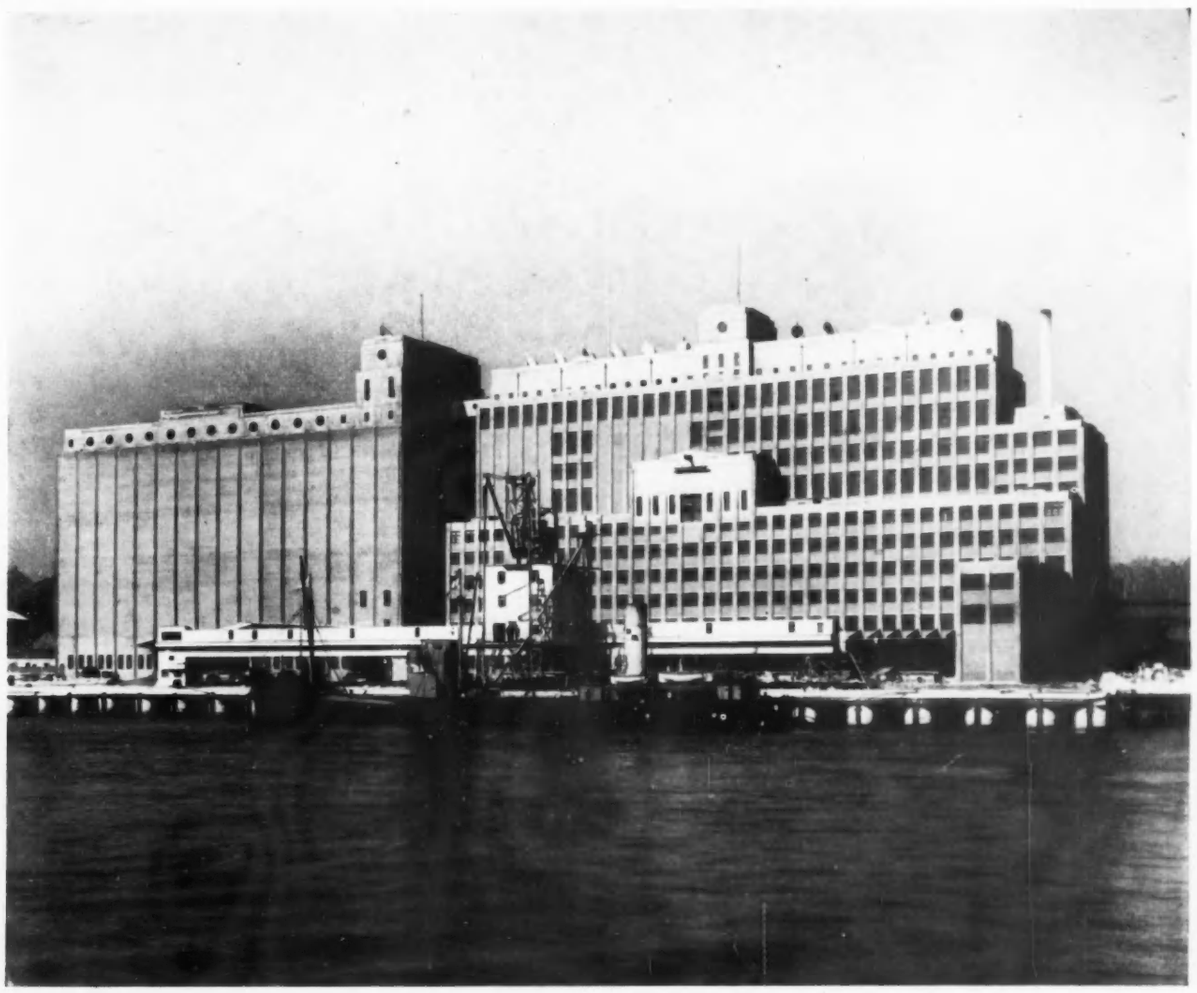


Fig. 12. Silos and Mill.

Generally speaking, the external piers are at 8-ft. centres. The building is 290-ft. long and 90-ft. wide, and has a maximum height of 168-ft. The portion which projects forward nearest to the quay wall contains machinery for animal foods.

The floors are generally of timber, similar to those of the warehouse described in the first portion of this Paper, and consist of 4-in. of Columbian pine, tongued and grooved, covered with 1-in. maple flooring. There is, however, a concrete floor dividing the warehouse from the mill for fire-resisting purposes, and provided with airtight bulkheads.

Where brickwork panels appear on the elevation without windows, service bins occur inside. These are for receiving the unwashed wheat as it comes from the silos across the bridge. From these bins the wheat is taken to the washing plant at the top of the building. It is then conditioned to the right degree of moisture and again elevated, whereafter it goes through the usual series of mills, in which it is fractionally ground, the various portions of the wheat being carefully separated and used for their appropriate purposes.

The reinforced concrete beams are generally of 28-ft. span and are rectangular (22-in. by 9-in.) in section, carrying the timber floor previously referred to. They are at 8-ft. centres so as to provide bays which are convenient for sprinklers and conform with the rules of the insurance companies.

The high building is 56-ft. wide and has a central row of reinforced concrete columns at 8-ft. centres. It was considered that when these columns reach the top of the warehouse they would be unpleasantly close for warehouse purposes at such spacing, and at that level every alternative column is carried on a large reinforced concrete beam so that the columns below are generally at 16-ft. centres (Fig. 13).

These beams are approximately 45-in. deep and 30-in. wide, and contain three layers of $1\frac{1}{4}$-in. rods, nine to a layer, as the main tensile reinforcement. The load on the columns which they carry at midspan was approximately 200 tons each, additional to the weight from the beams to the floor.

The central feature half-way up the building is the main motor room, in which the main motor, of approximately 850 horse power, drives all the shafting throughout the mill at the various floors by direct rope drives from the motor pulley to pulleys at all the different floor levels in the mill, one bay of the mill being reserved for this purpose to form a rope race. This ensures that when the mill is stopped or started all the processes will start and stop at the same time and will not fall out of phase.

The wall panels consist of hollow 11-in. walling constructed of a pleasing red brick, the two halves being connected together by wall ties of stainless steel, two to each square yard of wall. A lead core bituminous damp course was provided at each floor level across the cavity in the wall, so that any water passing into the cavity would be drained out through small spaces provided for

*Reproduced by permission from the Journal of the Institution of Civil Engineers.

†Fig. 12 (left-hand building) also illustrates the treatment of the Grain Silos described in the preceding issue.

Waterside Flour and Grain Storage—continued

the purpose. To achieve this, the damp course was 3-in. higher in the inner skin than in the outer one, sloping across the cavity between.

The central tower at the top contains the pressure tank for the sprinkler system. On the roof are the cowls from which the air is discharged after dust extraction in the cyclones. The topmost floor contains no windows, because it is the settling chamber in which the dust is collected before discharge.

The chimney is octagonal, of reinforced concrete, 4-in. in thickness, lined with moler brick for the whole height, and serves the dry back boiler on the ground floor which supplies steam for process work and for heating the offices, and also provides hot water through calorifiers.

In front of the buildings is the intake plant, which consists essentially of a long horizontal cylinder parallel to the quay, on to which the wheat is discharged from pneumatic plant that sucks the wheat direct from the hold of the ship. This pneumatic plant runs on rails and is designed to operate anywhere along the length of the quay within the limits of the intake conveyor.

From the intake conveyor cross bands deliver the grain into the receiving house to the right of the silos, whence it is elevated to the top.

Since the photograph was taken a garage approximately 200-ft. long and 40-ft. wide has been constructed in front of the silos.

A small portion of the warehouse to the left is arranged as offices.

On the far side of the mill a large cantilever canopy, projecting approximately 28-ft., enables two lines of track to be loaded simultaneously in the dry, while on the inner side of the mill a cantilever canopy with approximately 20-ft. overhang covers a loading platform and the tail end of outgoing lorries.

The warehouse is equipped with spiral shoots through the various floors, similar to those in the Southern Railway warehouse, but delivery to conveyors on the first floor which discharge direct to truck or lorry.

The buildings are carried on piles under a reinforced concrete raft.

The general layout was dictated largely by the exigencies of the site. The storey heights in the warehouse are 12-ft. for the lower storeys and 11-ft. for the next three, whereas the storey heights in the mill are 15-ft. for the lowest two storeys, 12-ft. for the next, 15-ft. for the next two, and 8-ft. 6-in. each for the uppermost two.

Fig. 13, a longitudinal section through the building, illustrates most of the points described.

Fig. 14 illustrates another flour mill, consisting of three buildings: the left hand one is the silo, with a receiving house tower at the right hand end and a bridge connecting across to the mill building, which is the flour mill, whilst the building at the right hand end is the warehouse.

It will be appreciated that the greater storey heights required for the mill did not permit the floors to be aligned with the warehouse, and to have done so would have entailed wastefulness in design and a suppression of the different purposes of the two buildings.

In this mill the silos are 265-ft. long, 155-ft. high, and 58-ft. wide, and consist of four bays of bins approximately 13-ft. 6-in. square, fifty-two large bins and sixty-four quarter bins being provided in addition to the open floors in the receiving house. The intervening bridge spans 74-ft. and gives on to the mill, which is 22-ft. long, 78-ft. wide and 104-ft. high.

The warehouse is 168-ft. long, 96-ft. high and also 78-ft. wide.

The mill is separated from the warehouse by double fire-resisting walls, with an intervening space and double fire doors at all openings.

Both buildings are fully equipped with sprinklers, the tank for which is situated in the ground floor of the warehouse.

Fig. 15 illustrates in cross-section the arrangement of the buildings in relation to the dock. An interesting problem arose in connection with the piling, which consists of 1,800 reinforced concrete piles, 16-in. square, to carry the three buildings.

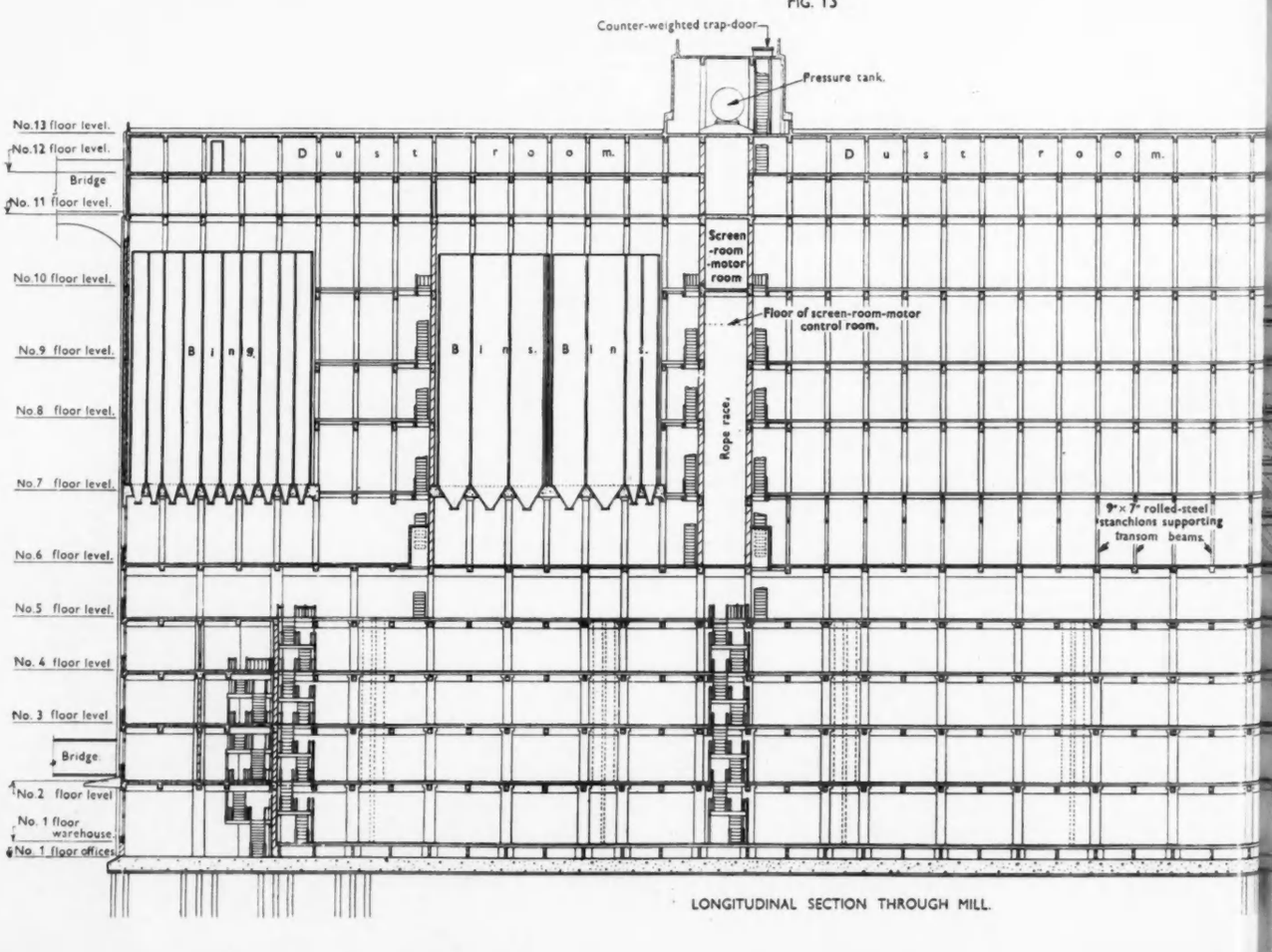
Borings indicated hard red marl at about 72-ft. below the surface. The upper 50-ft. consist of soft made ground, but between 50-ft. and 60-ft. there is a hard layer with a soft layer intervening between it and the marl. Apparently the dock wall was founded in the hard layer and overlies the soft layer.

When pile-driving began it was found that the piles obtained what would normally be considered an acceptable set in the hard layer, frequently taking as many as 100 blows in 1-ft. with a 4-ton monkey dropping 4-ft.

It was considered, however, that it would have been very risky to carry all the buildings on this upper hard layer in view of the soft layer immediately underlying it, and the fact that the dock wall had not been carried through the latter. Indeed, evidence that one portion of the dock wall had already moved forward and downward during its original construction was provided, on examination, by the presence of several courses of wedge-shaped stones to bring the dock up to a level cope, although it was left with a cusp in plan where the original outward movement of about 16-ft. had occurred.

Since the bottom of the hard layer was approximately 60-ft. below the surface, the pressure which would have been exerted

FIG. 13



LONGITUDINAL SECTION THROUGH MILL.

Waterside Flour and Grain Storage—continued

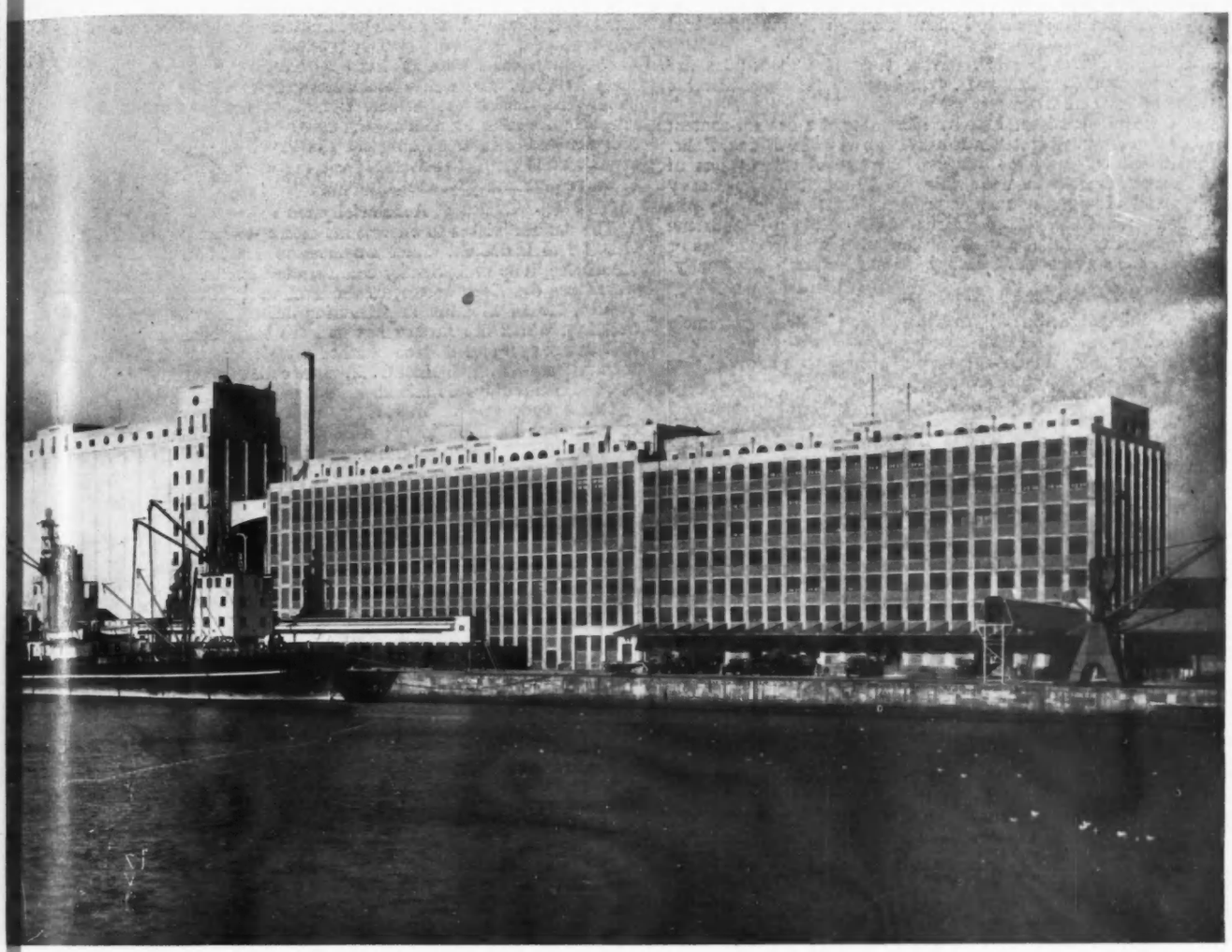


Fig. 14. Silos, Mill and Warehouse.

on the soft layer under the silo building, had the piles been stopped in the hard layer, would clearly have been as follows:—

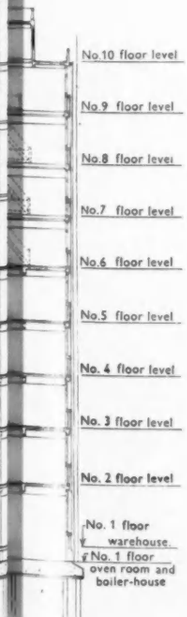
60-ft. of earth at 120 lb.	7,200 lb.	per square foot
Weight of silo building plus piles, divided by the area	7,800	„ „
	15,000	

Where the soft layer continues under the dock wall and under the bottom of the dock the load upon it is, however, as follows:—

30-ft. of water at 62 lb.	1,860 lb.	per square foot
16-ft. of earth at 120 lb.	1,920	„ „
	3,780	

There could thus be a hydrostatic difference of nearly 5 tons per square foot between the high pressure under the hard layer where it carries the piles and the low pressure under the hard layer under the dock, and it was considered that there was not sufficient guarantee that transfer of material would not, in these circumstances, take place from the highly-compressed portion to the portion under the dock, causing the building to settle, the dock wall to move into the dock, and material to rise in the dock bottom.

To avoid this risk, it was deemed essential that the piles should penetrate both the upper hard layer and the soft layer and reach the marl below. This involved specially hard driving, many of the piles needing more than 100 blows to the foot over a length



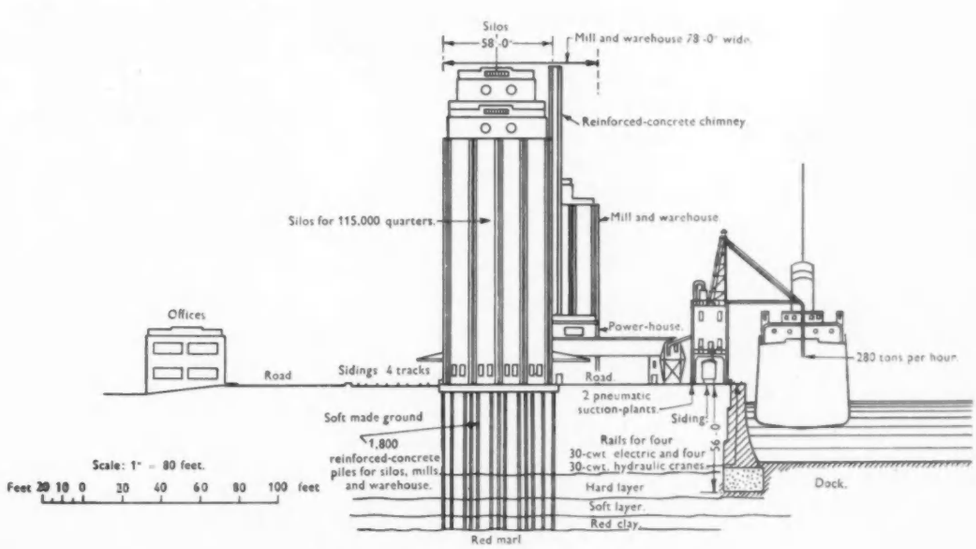


Fig. 15. Transverse Section through Quay.

Waterside Flour and Grain Storage—continued

of nearly 10-ft. before they reached the soft layer; but thereafter very little driving carried them through to the hard red marl.

This was, of course, much harder treatment than piles are normally required to resist, and in the early stages a considerable number of piles were fractured.

It was found, however, that by increasing the cement-content of the concrete, warming it to a temperature of 60 to 70 deg. Fahr. before deposition, and then keeping it protected against loss of heat, piles could easily be made which would resist this very heavy driving; and after some early experiments the rest of the pile driving proceeded through to the red marl and the red sandstone rock without any difficulty, and no settlement of the buildings or damage to the wall occurred during construction or subsequently.

Costs

The buildings described in this Paper were extremely economical.

The costs per cubic foot (pre-war) were approximately as follows:—

Silos	4d. to 5d.
Mills	9d.
Warehouses	6d. to 7d.

These figures are exclusive of foundations (which obviously must be considered separately for any particular site), lighting, heating, machinery, lifts, mechanical equipment, sprinklers, and fees.

The costs include framework, columns, beams, floors, walls, stairs, windows, waterproofing, rainwater goods, floor finishes and painting.

These low costs were achieved by treating the reinforced concrete so as to make it presentable without covering it (which incidentally makes the structure more honest and interesting), selecting the most economical bin-sizes, column-centres, etc., and designing the reinforced concrete and other structural units with consideration for the re-use by the contractors of shuttering, and of other practical problems.

Acknowledgments

The Author wishes to express his thanks to Mr. George Ellson, O.B.E., M.Inst.C.E., Chief Engineer to the Southern Railway, for advice, help and friendly collaboration in connection with the warehouse described herein; to the Technical Director of the mill owners, for his kindness in permitting description of a few of the buildings which the Author has had the honour of designing for his Company; and to the Author's assistant, Mr. K. G. H. Montgomery-Smith, M.Inst.C.E., who collaborated in the design of all the buildings described.

The Author also acknowledges, with gratitude, the help and collaboration received from the Technical Department of the mill owners, which was responsible for the layout and design of all the machinery in the buildings, and from Messrs. Peter Lind and Co., Ltd., Mr. Henry Wilcocks, Messrs. Richard Costain, Ltd., and Messrs. J. L. Kier and Co., Ltd., contractors for the various buildings described.

Notable Port Personalities

XVI.—Mr. R. J. Hodges

Mr. Reginald John Hodges, General Manager and Secretary of the Mersey Docks and Harbour Board, is the youngest son of Mr. and Mrs. W. A. Hodges. He was born in Mansfield, Woodhouse, Notts., and educated at Sedbergh and Trinity College, Oxford. In 1911 he went to South Africa to study agriculture, and was awarded a first-class Diploma at the Grootfontein School of Agriculture. On returning to England in 1914 he joined the Denbighshire Yeomanry and served in this regiment for the period of the war in Egypt, Palestine and France.

Mr. REGINALD JOHN HODGES.

Mr. Hodges entered the service of the Mersey Dock Board in 1935 as an additional assistant to the General Manager and Secretary. Formerly he held a responsible position with the Cunard Line in Liverpool, being in control of the company's staff and labour affairs. In 1930 he was transferred to Glasgow as general manager of the Anchor Line (Henderson Bros.), Ltd., and later became a director of the company. He terminated his association with the firm when it was taken over by Messrs. Runciman (London), Ltd. In 1939 Mr. Hodges was appointed to the newly created position in the Dock Board, Deputy General Manager, and on the retirement of Sir Lionel Warner in July, 1941, he succeeded to the post of General Manager and Secretary.

River Improvements in China

The following particulars of dredging and kindred operations, recently in progress for improving the navigability of certain Chinese rivers, are extracted from the July issue of *The Far Eastern Review*:—

Work to improve inland navigation over 9,254 kilometres of rivers in the provinces of Hupeh, Szechuen, Shensi, Kweichow, Yunnan, Hunan, Kwangsi and Sikang is partly in full swing, partly planned, according to the Ministry of Economic Affairs.

In the total length, work is proceeding on 3,879 kilometres, namely, dredging, dynamiting of sand bars, building dams and wharves. Work on the remaining 5,375 kilometres is being planned and surveyed. Following the successful conclusion of a trial cruise by an engineering party last September, engineers set to work to make the Gold Sand River navigable in sections. At present, boats of less than four tons can go from Ipin as far as Manyisze. When the whole project is completed, a 820-kilometre stretch will be navigable, linking western Szechuen by water with Yunnan.

Of equal importance is the 909-kilometres course of the Chialing River from Chungking to Paishuikiang in southern Shensi, which connects with the North-west. At present, only the section from Chungking to Hochuan is navigable to steamers of less than 300 tons throughout the year, while from Hochuan to Nanchung 200-ton boats can travel during the high-water season. The navigability beyond Nanchung is limited to boats of less than five tons.

Other rivers on which hydraulic work is being carried out are listed as follows:—

Rivers	Section	Length Kilometres
Wu	Peiling, Szechuen to Szenan, Kweichow	343
Chi	Kiangtsin to Kanshuichang, Szechuen	190
Min	Ipin to Chengtu, Szechuen	355
Heng	Anpien Szechuen to Yentsin, Yunnan	175
Yenching	Tengchingkwan to Tzeliuching, Szechuen	73
Yuan	Chingyang to Changteh, Hunan	490
Chingshui	Chungankiang, Kweichow to Chinyang, Hunan ...	416
Hsiang	Chungsha, Hunan to Hsiangan, Kwangsi	600
Kwei	Tsangwu to Hsingan, Kwangsi	348

Among the waterways under survey for navigation improvements are the 650-kilometre Ichang-Chungking and 372-kilometre Chungking-Ipin sections of the Yangtze. In the first section, steamers below 1,400 tons can navigate during the summer and those below 600 tons during the winter. From Chungking to Ipin, steamers below 800 tons can navigate during the summer and those below 400 tons during the winter.

Proposed Land Traffic Route Across Texan Coastal Waters.

A proposal has been mooted for the construction of a " combination tunnel, trestle and causeway structure " for highway traffic across to Bolivar Roads, in Galveston Bay, Texas. The plans indicate a tunnel under the channel in the bay, the south entrance of which would be at a 400-ft. pier to be constructed on the north side of Galveston Island and the north exit of which would be an artificial island, 1,000 ft. long by 150 ft. wide to be formed in Bolivar Roads at a distance of 2,000ft.from the entrance pier; thence the highway would continue by trestle for a distance of 3,200 ft. to a causeway, 1,300 ft. in length, on the southerly portion of the Bolivar Peninsula.

Notes of the Month

Improvements at Port of Mombasa.

The Harbour Advisory Board at Mombasa, Kenya, has proposed the expenditure of £28,000 on improvements at the port, including the enlargement of the Customs and storage premises, the provision of mooring buoys, etc.

Oslo Port Finances.

It is learned that the 1940-41 budget for the administration of the Port of Oslo estimated expenditure at four million kroner and receipts at only half that amount, the deficiency being attributable to the effect of the war.

Kobe Harbour Improvements.

The improvements which are in hand at the central pier in the harbour of Kobe are expected to be completed before the end of the year. The new pier will be the largest in Japan for coastal shipping. It forms part of a programme involving a total expenditure of 26,650,000 yen, which will require eleven years to complete.

New Pier at Port Alfred.

A new pier at Port Alfred, a fishery port in South Africa, lying between Port Elizabeth and East London, having been completed to the extent of two-thirds of its contemplated length of 900 feet, an inspection has been made by Mr. R. Stuttaford, Minister of Commerce and Industries, to determine whether the continuation of the contract was justified, as also an additional expenditure of £6,000 on dredging the river channel.

New Harbour on Ivory Coast.

By excavating a wide navigable channel from the Atlantic Ocean into a lagoon on the Ivory Coast of West Africa, the French authorities are creating a new spacious harbour for shipping which it is claimed will be one of the most secure harbours in the world. Work on Abidjan Harbour, as it is called, has been proceeding since June, and it is anticipated that it will be completed in two years' time.

Turkish Port Development.

It is announced that a contract in the sum of about £200,000 has been assigned to Messrs. Braithwaite and Co. (Engineers), Ltd., of London, for the reconstruction of piers at the Turkish ports of Alexandretta and Mersina and for the provision of port facilities at Alexandretta. These will consist of a new jetty, of the screwed cylinder type, with sheds, railway sidings and quay cranes. Both ports are connected by rail with Aleppo.

Swedish Port Traffic.

Statistics recently issued by the Swedish Board of Trade show a heavy decrease, attributable to the war, of about 50 per cent. in shipping at Swedish ports during 1940, as compared with the previous year. The traffic in the three ports of Gothenburg, Stockholm and Malmo fell far below the normal. Shipping at Gothenburg comprised 6.3 million net tons, against 15.66 million tons in 1939—a decline of 60 per cent.—and at Malmo the traffic diminished by 67 per cent. to 2.9 million net tons. Stockholm showed the smallest comparative decrease with a drop from 11.57 million tons in 1939 to 6.29 million tons, or 46 per cent.

Increase in Port Facilities at Calcutta.

The Commissioners of the Port of Calcutta have decided to effect certain improvements in the facilities available for shipping at the dry docks of the port. A better fresh water supply is to be made available and additional cranes installed. At King George's Dry Dock there is need of a heavy lift crane and, in default of ability to obtain a new crane at the present time, it is proposed to make use of one of the " creeper " cranes now being used on the construction of the new Howrah Bridge; this would be transformed into a travelling portal crane capable of lifting 23 tons at 90 ft. radius, 33 tons at 60 ft. radius or 66 tons at 40 ft. radius. A hundred additional keel blocks, manufactured locally, are on order for the same dock.

Appointment of South African Port Directors.

Colonel C. H. Hamilton, Controller of Transport Department of the Defence of the Union of South Africa, and formerly system manager at Pretoria of the South African Railways and Harbours, has been appointed Director of the Port of Cape Town. In reference to the announcement previously made of the appointment of Colonel J. D. White to a similar post at the Port of Durban, it should be explained that the appointment is an interim one. Colonel White has stated that no decision has yet been made by the Minister of Railways and Harbours regarding the permanent holder of the post. In the meantime, he would represent the Government through the Minister in respect of administrative questions arising in connection with the port and shipping at Durban.

Extension of Texan Port.

The United States War Department Corps of Engineers has approved a project of deepening and widening for the port of Brownsville, in Texas, at a cost of $762,000. If approved by Congress, the channels and turning basin at Brownsville and Port Isabel will be dredged to a depth of 32 ft. with a bottom width of 200 ft. In addition, the turning basin at Port Isabel will be enlarged and the outer pass between Bragos and Padre islands deepened to 35 ft.

Proposed New Swiss-Italian Waterway.

A proposal to construct a navigable waterway, nearly 400 miles in length, connecting the lake port of Locarno with the sea port of Venice, has been discussed and favourably received at a recent conference of Swiss bankers held at Lugano. The project would be important in the development of transit traffic with Central Europe by serving the St. Gotthard and Simplon routes. The port of Locarno would be remodelled and enlarged. The scheme is estimated to cost between six and seven million Swiss francs —say, about £400,000.

Retirement of Port Officials.

After 45 years' service with the Port of Bristol Authority, Mr. Arthur Webb, head statistical clerk, has retired. He was previously employed at the City Docks Granary and at the Dues Department in Queen Square, Bristol.

The retirement is announced of Mr. William Brown, harbour master at the port of Bowling, on the River Clyde. Mr. Brown has been in the service of the London Midland and Scottish Railway, who own the port, and their predecessors, the Caledonian Railway, for 36 years.

A period of long service under the Sharpness and Gloucester Dock Company has come to an end with the retirement of Mr. A. J. Cullis, the Manager and Engineer of the undertaking. Mr. Cullis first became associated with the Company in 1891, and until 1931 held the position of engineer. Then, on the retirement of the late Mr. Manning Lewis, he was appointed manager. He is succeeded as General Manager by Mr. A. C. Lisle, who for the last few years has been Assistant Manager, and previously, Secretary. Mr. Lisle is also the Chief Executive Officer of the Port Emergency Committee and chairman of the South West Regional Canal Committee.

American Port Congresses.

Three important American port and waterway Congresses are to be held during the month of November. In the first week of the month there will be the thirtieth Annual Convention of the American Association of Port Authorities, followed at a week's interval by the thirty-fourth Annual Convention of the Atlantic Deeper Waterways Association and a special session of the National Rivers and Harbours Congress. The purpose of the last-named is stated to be (*inter alia*) " to consider our present and future programme of river and harbour development, flood control, maritime and inland navigation, with special reference to the urgent necessities of national defence."

Great Western Railway Ports Staff Changes.

Mr. L. E. Ford has been appointed assistant chief docks manager at Cardiff. He has held the position of principal assistant to the chief docks manager since August, 1939. Previously he was assistant docks manager at Swansea and docks manager at Port Talbot and Cardiff.

The new docks manager at Cardiff and Penarth, following the retirement of Mr. H. B. Smith, is Mr. D. G. Hoppins. He was formerly assistant docks manager at Newport and traffic and marine agent at Weymouth. Mr. Smith had been docks manager at Cardiff since 1939, and prior thereto was docks manager at Newport.

Completion of New Swedish Canal.

The completion is announced of the new Falsterbo Canal, which has been under construction since early in 1940. By cutting through the Falsterbo peninsula in the South of Sweden, it opens a new connection between the Baltic and the Kattegat, making it possible for vessels of draught too great to use the five-metre channel off the Swedish coast at this point, to pass inside Swedish territorial waters, when leaving or entering the Baltic through the Sound. The canal, which has been constructed by the Swedish Board of Roads and Waterways, runs from Holviken on the Sound to the Bight of Kampinge on the Baltic side. Its length is about 27 kilometres. The actual canal distance through land is about 1.5 km. and a further 17 km. has been dredged to give the requisite depth. The breadth varies from 44 to 110 yds. and the depth is about 24 ft. The canal will probably be opened to ordinary traffic before the end of the year. The cost of the undertaking has been about £1,176,000.

Tugs for Port Work

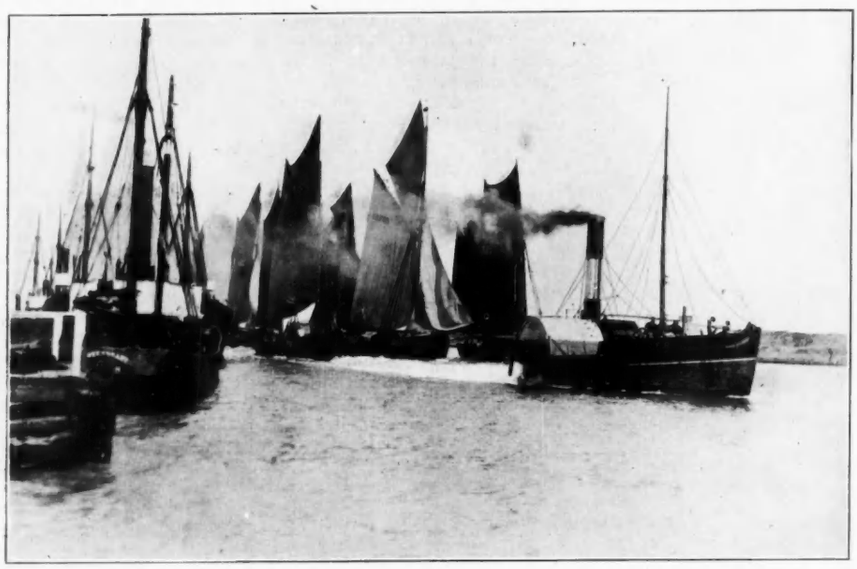
The Development of an Important Service

By FRANK C. BOWEN

GENERALLY SPEAKING, the tug has been very lightly treated by literature, text books and the learned societies, and such attention as it has received has been concentrated on the bigger types. Yet everybody who has anything to do with port administration and working knows how essential the tugs are. Their personnel is essentially practical; until quite recently it might be said that all their work was done by rule of thumb, but it was based on sound experience and the manner in which the towing business ran in families. It left the history and development of a big business a matter of hearsay and tradition, which are terribly liable to get warped.

Early Experiments

Apart from the first experiment of mounting a locomotive engine on the deck of a Tyneside keel, and many trials by the pioneer steamboat inventors who nearly all aimed at towing sailing vessels, the earliest tugs were built on the Tyne for the express purpose of getting the sailing colliers clear of the river in a foul wind. It must be remembered that these colliers then ran into hundreds, and foul winds on the North East Coast would not only cause a coal famine in London but would congest the Tyne until serious hardships resulted. From the Tyne, tugs spread to the Clyde, Thames and other river ports, generally of very poor quality and incapable of towing more than a few miles. On the Thames, for instance, Limehouse was reckoned as the limit of towing for years, then Blackwall Point and then Gravesend, but some of the pioneers were unable to tow a sailing vessel as far as Gravesend without going alongside and borrowing coal from her galley bunkers. Towing out of sight of land was not considered and even coastal work was never undertaken by any but the naval tugs.



[Nautical Photo Agency

Clinker-built wooden paddlers like the "Reaper" did very big business in the fishing ports while the sailing smacks lasted, towing them clear of the harbour mouth in batches. The usual charge was half-a-crown for each smack under 25 tons and five shillings for each one over.

Within the limits of the ports, however, big improvements were made and the more powerful and more reliable tugs were fully employed. Steamers were beginning to get the business of the old sailing ships, and it was no longer possible for the latter to waste time as they had formerly done. Ships would wait for weeks for a fair wind, and there were constant reports of cases in which the steamers had gone out and home again before the sailing vessel had left port. The pioneer tugs were generally owned by men of the waterman type, who did wonders with their material but seldom had the capital to build what was really wanted. In some cases, they were financed by shipowners who knew their ability and, in others, the shipowners built their own tugs. In other cases again, local solicitors or ships' chandlers would form a syndicate; whatever the means employed the progress was steady.

Effect of Crimean War

It was, however, very slow until the 'fifties of last century. It was really the Crimean War of 1854-56 which made the big difference and its influence was first felt on the Thames. Both Woolwich and Deptford Dockyards were in full swing; Woolwich Arsenal was at work on munitions and Deptford victualling yard was already pre-eminent for victuals. Many of the munitions which came down from the North were most conveniently shipped in the Middle Reaches, so that a single general cargo for the front might come from a dozen sources on the river. The available steamers were mostly busy on the transport of troops, so that munitions, food and clothing had to be carried out by sailing vessels, which almost invariably drew their cargo from half a dozen places. In the case of the larger "parcels," the ship would often be towed from point to point, but most of the smaller consignments were taken to her by lighter, and so much haste was necessary that the tide was no longer trusted.

The result of this was a big boom in tugs of all kinds. Some were given a gross tonnage of 200 and over, and had enough power and coal to give their ships an offing by towing them right down to the Nore or even further. They also towed from berth to berth on the river.

There were also quite a large number of craft tugs built to handle the lighters and the smaller sailing ships like fruiters and colliers. The specialised craft tug was to come later. Both the large and the small type were appallingly inefficient, judged by modern standards, but they were worked hard, making an immense difference to trade and to the prosperity of the ports by permitting the sailing ship to continue to carry the cargoes which suited her best in face of competition from the steamers.

Practically all these tugs were wooden-hulled, although the first experimental iron hulls had been constructed on the Tyne soon after the Crimean War, and all were propelled by paddles. Nearly all had side-lever engines. For a good deal of close work in ports, especially handling lighters and other craft, the paddle was undoubtedly most inconvenient by its projection, as well as being inefficient in its utility of power. For many years, however, it had advantages which caused it to be preferred, although some of these were solely due to the designer's lack of courage in completely changing his ideas for the screw, and clinging to many paddle conventions which spoiled the newer system.

The small pioneer tugs, trying to overcome the initial inertia of a heavy ship in restricted waters, were naturally terribly liable to be girded at the least, possibly pulled right over. In order to right them, or to get extra power on one side or the other it was necessary to immerse one side more deeply. To do this, and also to prevent one paddle being completely out of the water owing to the tug's heel, a simple device known as the chain box was used. A square box on wheels, it was filled with chain cable and pushed from one side of the dock to the other as required.

Greater stability and the introduction of double-engined tugs, in which it was possible to put one paddle ahead while the other went astern, turning the tug in her own length, overcame the necessity of the chain box, double-engined tugs becoming general after the Crimean War. The feathering paddle float, invented in 1816 but neglected for many years, was another great improvement.

The prejudice against screw tugs, largely because it was a long time before a really efficient screw was invented for them, found expression in many ways. The sea tugman declared that no matter how heavy the weather, the paddler always had half her power in the water. The river and dock man pointed out the advantage of the paddler's shallow draught, her handiness, her ability to back down to her tow under perfect control while a screw boat would yaw all over the place, and many other points.

For sailing ship work in port, a very large part of the business, the paddle tug was always demanded as "second boat" long after she was considered obsolete. Lashed alongside the tow she could put her paddles full astern and check the way of the

Tugs for Port Work—continued

ship in a matter of moments; the average screw tug took some time to grip the water.

Although there were tugs "seeking" for sailing ships out of every British port from the middle of the nineteenth century onwards, the actual work in the harbour or river, which was very important, was always a separate job and seldom done by the tugs which had been seeking down Channel. Vessels which managed to save money on a tow outside the port had to seek the help of steam when they were inside. In addition to smaller tugs maintained by the big owners, generally working on contract, there were any number of other boats, often owned by their skippers and run on extraordinary lines, to pick up what port work they could. Most of them were old seagoing tugs, too decrepit to face bad weather, and of some of them it is told how the firemen had to borrow sea boots to go into the stokehold to raise steam for pumping out in the morning. These "toshers" would turn their hand to any job which came their way, not always reputable and did an immense amount of port work, although generally inefficiently.

[Nautical Photo Agency

Mersey Docks and Harbour Board tug getting a steamer away from her berth in Birkenhead Docks.

Speciality in Tug Design

As craft work demanded so much less power than ship work the business was handicapped for many years because so many people thought that any tug would do for the job. For a long time there was no thought of evolving a special type; declassed sea tugs, provided they were small enough, any little "tosher" which was available, and even converted passenger steamers. They made the barges more efficient than when they depended entirely on the tide, but little more could be said for them. The conditions under which they worked varied with the port, but when proper attention was given to them it was soon found that special designs paid just as well in their case as it did in other types. Practically every area now demands its special design; for ordinary craft work in the Port of London, 75 feet long and 500 brake horse-power is about the useful limit, but special jobs may want more. The usual Thames formation is six barges, two abreast, lashed together and towed close up to the stern of the tug. That is very important; the swim-headed barge is far easier to tow when it is in a position to let the propeller stream get away. It requires very pretty judgment to get a long tow of such barges through a bridge, or to swing them into a tier or the entrance to a dock, but the craft tugmaster is a highly skilled man and is generally given excellent material nowadays. Constant bumping by barges, or against dock walls, demands a very strongly built hull with rubbing bands and plenty of fenders; to overcome the jerks of craft work, a special towing hook is advisable and a special forging is needed to give the necessary tremendous strength to the counter. The Diesel engine for tugs first showed its qualities for craft work and it is now very generally installed.

Fire has been one of the greatest fears of port authorities from time immemorial, and in the event of one of the frequent outbreaks on the quays, the watermen's first job was to tow ships out of harm's way, no light task with wherries. The fire-fighting apparatus was limited to manual fire engines, of the type used on land, mounted on rafts and towed by pulling boats to the scene of the trouble. Steam tugs were an obvious advantage and were used in an emergency from their first conception; it would seem that the first tug specially designed and maintained for towing a fire raft was the *Beaver*, commissioned on the Thames in 1860. By that time the engine used was a great improvement on the old manual, and these rafts were capable of doing good work. Tug and raft were paired and maintained together; the tug *Arrow* and the raft, *Ajax*, the *Beaver* and the *Buffalo*, the *Cricket* and the *Cormorant* and the *Dodo* and *Dart* did yeoman service on Thames for years before the shallow draught self-propelling fire float was evolved, although the tugs were maintained for some years after that date. Although the first raft is long obsolete, port tugs still do excellent work against fire and the A.R.P. measures taken by British ports before the actual outbreak of war would have been impossible without the services of the type. Although air attacks were not really serious in the last war, the various port authorities took precautionary measures and many made it a rule to lock tugs with powerful fire pumps into their docks every night. They are equally useful for a fire patrol in the open river. By the enterprise of several firms, among which Messrs. Merryweather, of Greenwich, are conspicuous, the fire equipment has been greatly improved during the last few years and the pumps have been adapted for use in salvage operations as well.

The popular picture of salvage is generally concerned with the more picturesque aspects in deep water, but work within the limits of a port may easily be far more important; there is the same value to be salved and the obstruction of a fairway is of far more importance than in the open sea. Tugs have been used for that purpose ever since their invention, and have done really useful work since the great improvement in the 'fifties. Nowadays most of them are fitted for salvage purposes, but, in peace time, they do little work outside compared with that they used to do. Inside the ports, however, their work is invaluable.

Shipyards are generally situated within port limits and tug services are essential, not only for the safety of the ships but also for the conservancy of the port. Shipbuilders employed tugs from the first, and it was the launch of the P. and O. steamer *Iberia* in 1837, attended by Messrs. William Watkins' pioneer tug *Monarch*, which first brought the two firms into contact and started a connection which has lasted over a century. A modern ship taking the water, very light and without any means of helping herself, is entirely dependent on her tugs, and in the Northern yard paddlers are still favoured, provided the power demanded is not great, on account of their stopping power.

[Nautical Photo Agency

"Sun IX" belonging to Alexander's London fleet which is employed almost entirely on docking work in the port and seldom considers an outside contract.

Docking Tugs

Even the biggest of the early steamers were small and the tugs were fully employed enabling sailing ships to maintain their competition. As steamers got bigger, and enclosed docks came more and more into fashion, it became impossible to move them in safety without assistance, especially in bad weather, and the tugs took up a new job, docking work, which has since become their principal employment. It caused them to be given better stability, for several of the old narrow type were capsized when girded, and different ports demanded different qualities. In the United States, for instance, where many of the ports have piers set athwart the current, the dock-

Tugs for Port Work—continued

ing tugs do an immense amount of pushing as well as pulling, and the same system is followed to a certain extent in some British passenger ports.

Docking work is a very highly skilled job which calls for great efficiency on the part of the tug skipper and close co-operation between him and the pilot, as the ship is responsible for mishaps. The tow ropes have to be given just the right angle and the tide taken into consideration at every turn. The tugs must be ready to cast off, take up a new position and start towing or checking again at a moment's notice, and to one watching the operations perhaps the most remarkable part of them is the extraordinary co-operation between the master on the bridge and the " driver " in the engine room. This co-operation is often very necessary when a few revolutions of the propeller, at exactly the right speed, will do just what is wanted, but the landsman on board inevitably finds it impossible to detect the means by which so precise an instruction is conveyed.

Passenger Tenders

Although the passenger tender work is greatly reduced by the improvement in the landing stages in most ports, there is still a good deal of it to be done, sometimes owing to lack of stage facilities, sometimes owing to these being overcrowded, and sometimes because opportunities exist for shipowners to save money by handling their passengers in the stream instead of alongside. A passenger certificate is readily granted to an ordinary tug when proper precautions are taken, including the provision of fire extinguishers even though she may be equipped with immense fire pumps, but in some ports special tug-tenders are built with promenade decks and saloon accommodation. This generally means putting the towing hook in a very awkward position, which would be a severe handicap for most forms of work, but is of little importance in docking jobs. Going alongside a passenger liner it is, needless to say, necessary for the tugmaster to take every care that he does not discharge clouds of smoke on to her promenade decks. In the old days of primitive boilers, a liner's passenger decks were always liable to be cleared when the tug alongside started priming.

Dredging Service

Practically every port authority has to make great use of tugs, in connection with the dredging service, and most of the big dredging contractors maintain first-class fleets. Primarily, of course, it is for the purpose of towing hopper barges out of the port to the grounds where they can discharge their spoil, but tugs are also in constant demand for moving the dredgers to their appointed positions, tending to their moorings and generally keeping them supplied with water and other necessities. Many are fitted with rakes and blowers to permit them to dislodge accumulations of mud and sand from odd corners into which the dredgers cannot penetrate, and to get the silt into the tideway. In many ports which have no special material for the purpose they are also used for surveying before and after dredging operations.

Most dock and harbour authorities maintain at least a few tugs for their own purpose, independent of the private owners with whom they work. The authority naturally likes to have the handling of ships inside the docks, where a mishap may mean so much, under its own control, and these " inside " tugs are frequently fitted with watertube boilers which permit the very rapid raising of steam. Private owners usually prefer the old Scotch type with its rugged simplicity. Floating cranes have to be towed from point to point where they are needed, and if the work is carried out with its own material the authority is in a much better position to quote a price. In ports which are too small to attract private firms, the authority must provide the facilities itself, and, in many cases, this has been done when the quality of the private service is considered to be too low for the requirements of the port.

Towing Power

The poor qualtiies of the early screw tugs prolonged the life of the paddler, but a better understanding of the problems, and finally scientific investigation into both screws and hulls, have made her supreme, and the paddler is now only considered in special circumstances. The tug is always largely dependent upon her hull for the ability to put her horse-power to good use, and where draught is not a major consideration the modern hull is beautifully designed with a deep heel, a clean run and good buoyancy forward. The normal tow-rope pull of a modern screw tug is generally reckoned at one ton for 100 indicated horse-power, but this has been exceeded. In the Southampton twin-screw tug *Clausentum*, for instance, the designed i.h.p. of 1,200 was intended to give a tow-rope pull of 14 tons, but when she was tried it was found that 1,350 i.h.p. gave 17½ tons.

Shortly before the last war Messrs. Thornycroft tried one of their latest paddle tugs against an up-to-date twin screw. Running free, the *Sturdy* of 866 i.h.p. used 58 per cent. of her power, while the twin-screw *Neptune* of 1,170 i.h.p. exercised 73 per cent. Towing, the advantage was even greater.

It should be noted that too big a power can prove a serious disadvantage for docking work by causing innumerable broken tow-ropes. In many cases modern vessels have been given the biggest reasonable power for use in case of emergency, but normally work with the engine linked in.

When the Diesel engine was first considered for marine use, its advocates had great hopes of the towing business, pointing out the advantages of not burning any fuel during the large proportion of her time which the tug spends standing by, the more compact machinery through the elimination of the boiler, the economy in fuel and the ability of the engine to take a very big overload for a considerable period. Although the Atlas Company, which has since engined so many, provided the machinery

[Nautical Photo Agency

"Turecamo Boys," is a typical American tug, differing radically from British practice. The disadvantage of having the towing hook so far aft is a minor matter in craft tugs which do practically all their towing alongside, especially in the railway car float business, which is such a feature of New York and other American Harbours.

for a motor tug on the Volga in 1909, the industry as a whole was slow to take up internal combustion engines. Owners were nervous of the necessity of having highly skilled engineers, the height of the average Diesel was a disadvantage, the manœuvring ability, particularly important for harbour work, was limited by the air supply, the engine speed was liable to be too high and the Diesel still had the reputation of constantly breaking down.

The motor tug has not yet replaced the steamer for all purposes, and many doubt if it ever will, but most of the well-known engineers have overcome the early disadvantages, and although the Diesel is not usually regarded as being suitable for docking work, unless it is coupled with the flexible electric drive which inevitably means a high capital cost, it has an assured position for craft work, in which its qualities show to the very best advantage. To save weight, a number of motors have been geared down to obtain a satisfactory propeller speed, but in any circumstances the lighter engine permits more weight to be devoted to the hull, a particularly desirable feature for craft work. The smaller engine room crew of the ocean-going motorship is only obtained in certain working conditions in a tug. The ordinary tug engineer has been found quite capable of looking after the average robust Diesel, and the improvement of the reversible engine has overcome the old air difficulty. In the United States, especially, a very large number of steam tugs on port work, some of them fifty years old, have been converted to Diesel power with excellent results, but very special care has been devoted to the installation when it was intended to use them for docking work.

Craft towing may cover a wide range of differing conditions in different ports, or even in the same port, and the best results are obtained by a special design for each type of job. In the Port of London, for instance, there is an immense amount of craft work above Blackwall, but there is also the long-distance work

Tugs for Port Work—continued

to Tilbury or to the oil depots at the Havens. For long tows the most careful organisation possible is necessary, not only to take full advantage of the tide but also to miss the principal traffic jams and, in the case of spirit barges, to avoid being caught between stations by nightfall.

Car Float Work

A particularly interesting branch of craft work is the movement of the railway car floats across many American ports. These tugs are invariably owned by the railways, and while the passenger cars are taken across in self-propelled ferries the immense freight business is dealt with in specially designed floats, hogged for strength, which are towed across the traffic by tugs which invariably work alongside. New York, San Francisco, Philadelphia, Baltimore and other ports handle a very large traffic in this manner, and it demands a magnificent organisation. The floats are rectangular in plan and vary greatly in their size; an average may be taken as 145 feet to 230 feet in length, by 22 feet to 34 feet in width, and a load draught of from 3 feet 6 inches to 5 feet. Some of them are considerably bigger, running to 250 feet and over. The " float tugs " are used assembling and towing the floats and barges from the railway terminals to the piers and the " transfer tugs," running rather bigger, from one terminal to another. They have no accommodation for their crews, who work in comparatively short shifts and then go ashore, and the speed with which they work, and the precision with which they place the floats so that their rails coincide with these of the terminal, is remarkable. 500 to 800 i.h.p. is an average power for the tugs on this work, but there are a number both more and less powerful.

For port work in the colonies and dominions a big power is often demanded. Many of the " Saint " class rescue tugs, built for the Navy during the late war, have been bought for this service, while other harbours, notably those under the administration of the South African Government, have had built a number of specially designed tugs of great power.

During the late war with Germany, and again during the present one, port tugs have proved that they can be of just as great national importance as the seagoing tugs whose work attracts very much more popular attention. In addition to the fire and salvage duties already mentioned, they maintain a constant port patrol and look-out for enemy operations, especially since minelaying from the air has come into fashion, act as tenders for the guardships and other services, tow barges with ammunition, maintain the examination and minesweeping services within the ports and on rivers, tend the gates of the boom defences, transport workmen and troops and fulfil a score of other functions. The intimate local knowledge of the port tugmaster, and the handiness of his ship for local conditions, have proved their value time and again on active service.

Dock Labour Regulation

Essential Work (Dock Labour) Order, 1941

Under the Defence Regulations, 1939, the Minister of Labour and National Service has issued an Order, as above, dated September 15th, 1941, from which the more important provisions are set out hereunder.

Defining a " dock labour scheme " as a scheme which has for its principal objects the rapid handling of goods and turn round of ships in any port by establishing an adequate regular and mobile labour force for undertakings engaged in port transport work and by keeping a register of such force and undertakings; and a " port registration scheme " as a scheme approved by the Minister under the Dock Labour (Compulsory Registration) Order, 1940, it is laid down that the Minister may approve any scheme submitted to him by the National Dock Labour Corporation, Ltd., dealing, *inter alia*, with the appointment and functions of a manager and a dock labour board, the terms and conditions of service of transport workers and the payment of their wages, the keeping of a register of port transport employers and port transport workers, the establishment of a Reserve Pool of labour and the allocation, engagement and control of port transport workers.

Where in any port an approved dock labour scheme is in force the following provisions are to apply:—

(a) port transport work in the port is to be carried on only by port transport employers and by port transport workers, and accordingly—

(i) no person other than a person who is or who is acting on behalf of a port transport employer shall employ any worker on port transport work within the port;

(ii) no person shall employ any worker other than a port transport worker on port transport work within the port;

(iii) no person other than a port transport worker shall be employed on port transport work within the port;

(iv) a port transport worker shall not be employed on port transport work within the port otherwise than by a person who is or is acting on behalf of a port transport employer; and

(v) a port transport employer shall not employ a port transport worker and a port transport worker shall not be employed by a port transport employer, except in either case in accordance with the provisions of the scheme;

(b) A port transport worker so long as as he is not employed in a port transport undertaking or in other work to or for which he has been allocated or sent by the Corporation shall be in the Reserve Pool and be in the employment of the Corporation; and

(c) where a port transport worker is employed by the Corporation:—

(i) he shall report at such places and at such times as may be required by the Corporation, shall be ready to perform for any person any suitable work offered to him by the Corporation or to render any services considered by the Corporation to be necessary for the purpose of clearing the port or enabling work to be carried on therein or any fire prevention services over and above such as are required by law and shall travel as required to any other port or place for the purpose of performing work in accordance with the provisions of the scheme at that port or place;

(ii) his employment by the Corporation shall not be terminated either by himself or the Corporation otherwise than in accordance with the provisions of the scheme; and

(iii) his conditions of service as regards pay, allowances and other matters shall, subject to any conditions contained in the scheme, be such as the Corporation may from time to time determine and in making any such determination the Corporation shall have regard to any determination for the time being in force of the National Joint Council for Dock Labour or of such other joint body as may be appropriate.

Where in any port an approved dock labour scheme is in force the Corporation and every port transport employer shall—

(a) keep such records relating to the port or to the undertaking (as the case may be) as the Minister may from time to time direct;

(b) produce to such persons as may be designated by or on behalf of the Minister such records relating to the port or the undertaking and furnish such information relating thereto as may be set out in any notice or direction; and

(c) permit any person so designated as aforesaid to enter and inspect with a view to securing compliance with this Order any premises in the occupation of the Corporation or any premises used for the purposes of port transport work by a port transport employer.

Explanatory Memorandum by the Minister of Labour and National Service

In connection with the foregoing Order, an explanatory Memorandum has been issued by the Ministry in which it is stated that the provisions of the Order and the new terms of employment will not apply in a port unless and until a scheme for that port has been submitted by the Corporation, approved by the Minister of Labour and National Service, and is in operation. The preparation of schemes for the principal ports will commence immediately, but the Order will not be applied to the Merseyside and Clydeside ports (where the Minister of War Transport is now the employer of all port transport workers) without further consideration. The National Joint Council with the agreement of the Minister of Labour and National Service has established the National Dock Labour Corporation Limited to finance and administer approved schemes.

The Corporation is a Company limited by guarantee and not having a share capital. The Board of Directors consists of a Chairman appointed by the Minister after consultation with the Council, a Finance Director appointed by the Minister, and six directors nominated by the Council.

The cost of all schemes will be met from a National Management Fund maintained by the Corporation. Employers under approved schemes will be required to make a contribution to the Fund which will not, under present arrangements, exceed 25 per cent. of their gross wages bill. The Fund will be underwritten by the Exchequer which will, in addition, make a contribution in respect of certain administrative expenses of the Corporation. It is intended that the Corporation shall ultimately take over from the Ministry of Labour and National Service their responsibility for arranging transfers of port transport workers from one port to another.

The following extracts from the Memorandum relate to a Model Dock Labour Scheme set out in full in an appendix thereto:

Administration

Local Boards and Managers will be appointed by the Corporation. The Local Boards will be responsible to the Corporation for local administration.

Dock Labour Regulation—continued

The Port Registration Committees will continue to register port transport workers and employers and will have the duty of deciding which workers are from time to time to be employed under the schemes, but they will not control the arrangements for engaging labour.

The National Joint Council and the Local Joint Committees will continue to be responsible for industrial negotiations, including the establishment of piece rates wherever practicable.

Terms and Conditions of Employment of Port Transport Workers.

The scheme will apply to all port transport workers although the position of men in permanent employment (i.e. men subject to not less than a weeks notice) will not be affected.

Other transport workers selected by the Registration Committee for inclusion in the scheme will cease to be casual workers and will always be in employment. While employed in port transport work or other work for which the scheme provides, the men will be under the sole direction of the employer to whom they are allocated and will be paid the rate for the job. Immediately the job is completed they will come automatically into the Reserve Pool and will be in the employment of the Corporation.

When in the Reserve Pool the men will be required to report at an appropriate control point as required and, if not allocated to employment will be entitled to attendance money at the rate of 5s. for each of the eleven half days which they attend the call and offer themselves for employment. The amount of attendance money due from the Corporation will not in any circumstances be affected by the amount of time or piece rate earnings due from an employer in respect of day, overtime, or weekend work.

Special arrangements will be made for aged and light work men who are unable to do a full week's normal work.

Organisation and Discipline.

The maintenance of a regular and mobile force for this vital work requires a standard of organisation and discipline far higher than that which was possible under the casual scheme. Accordingly it is provided that

(a) employers will not be be entitled to engage in port transport work unless they are registered, and they will only be allowed to employ on such work registered port transport workers who are either their own permanent men or have been allocated to them by the Manager. They must give due notice of their labour requirements, keep records, and pay to the Manager each week the gross wages earned by the men together with the prescribed contributions to the National Management Fund. An employer who fails to comply with the requirements of the scheme may be removed from the register subject to an appeal to the Minister.

(b) any man who fails without adequate cause to attend at the control point, or to accept employment for which he is suitable, or otherwise fails to carry out the conditions of his contract (as set out in the model scheme) will lose his attendance money for that week. Additionally he may be suspended from the scheme without payment, given seven days' notice to terminate his employment under the scheme, or, in the case of serious misconduct, summarily dismissed; in all such cases the man has a right of appeal to a joint appeal panel set up by the Local Joint Committee whose decision, if unanimous, is final. In the event of disagreement the case may be referred for decision to the National Service Officer appointed for that purpose.

Payment of Wages.

The existing practices of "subbing" and daily payments by the employers will be abolished and all wages due, whether from employers to whom men have been allocated or from the Corporation, will be paid weekly (probably on Thursday) by the Manager. To enable the wages sheets to be prepared the pay week will necessarily end some days earlier. The Manager will also hold and stamp the men's insurance cards.

Termination of Employment Under the Scheme.

Except in cases of summary dismissal for serious misconduct, seven days' notice must be given before a port transport worker can leave or be discharged from the scheme. If objection is raised, and also where an appeal is made against summary dismissal for serious misconduct, the case will be referred to the Appeal Panel of the Local Joint Committee whose decision if unanimous is final and may be supported by a direction of the National Service Officer. If the Panel is not unanimous, the case may be referred to the National Service Officer for decision.

Holidays.

Men who fulfil conditions which will be laid down by the National Joint Council will be eligible for an annual week's holiday for which they will be paid 80s. or 75s. according to the size of the port.

Copies of the Order (price 1d.) and of the Memorandum (price 2d.) can be obtained from H.M. Stationery Office.

Directorate of the National Dock Labour Corporation

The following gentlemen have been appointed Directors of the National Dock Labour Corporation, Ltd.:—

Chairman (appointed by the Minister of Labour and National Service after consultation with the National Joint Council for Dock Labour): R. T. Garrett, Esq., Chairman, National Council of Port Labour Employers; Director, Anderson Green and Co., Ltd. (Managers of the Orient Line); Member of Port of London Authority.

Financial Director (appointed by the Minister of Labour and National Service): H. M. Barton, Esq., senior partner of Messrs. Barton, Mayhew and Co., a member of the Council of the Institute of Chartered Accountants.

Directors (nominated by the National Joint Council for Dock Labour): A. Deakin, Esq., Acting General Secretary of the Transport and General Workers' Union, member of the Council of Trade Union Congress; A. Howell, Esq., director of Dent's Wharf, Middlesbrough; R. H. Jones, Esq., general manager of the Port of Bristol Authority and chairman of Bristol Port Emergency Committee; D. W. Milford, Esq., National Dock Group Secretary, Transport and General Workers' Union; Sir Douglas Ritchie, general manager, Port of London Authority and Chief Executive Officer of the London Port Emergency Committee; and W. M. Turner, Esq., General Secretary, National Amalgamated Stevedores and Dockers.

General Manager: S. C. Parkin, Esq., Docks Adviser to the Ministry of Labour and National Service, lately Secretary of the Port of Bristol Employers' Association and member of the Council of the British Employers' Confederation.

Secretary and Assistant General Manager: F. G. Thomas, Esq., who, during his service as an Administration Officer in the Ministry of Labour and National Service, has been concerned with dock labour problems.

Chief Accountant: D. Lemon, Esq., Principal Assistant to the Chief Accountant of the Port of London Authority.

The offices of the Corporation are at 9, Upper Brook Street, London, W.1.

Obituary

At the ripe age of 77, **Mr. James D. Gilbert, D.L., J.P.,** former Member of Parliament and for 26 years a member of the Port of London Authority, has passed away. He was a member for 37 years of the Thames Conservancy and chairman of that body during 1937-38 and also a member of the London County Council for 30 years.

The death is also announced of **Mr. Andrew Brown,** chairman and joint managing director of Wm. Simons and Co., Ltd., shipbuilders, of Renfrew. He belonged to a family that has been associated with Clyde shipbuilding for nearly a century and a half. His grandfather was early associated with the founder of Simons, which was established in 1810. Like all members of this shipbuilding family, Mr. Brown was an authority on dredgers, and among the firm's last contracts before the war were two dredgers for Russia.

The Ports of Ceuta and Tetuan

(*Concluded from page 4*)

district. The town is just visible from the so-called Bay of Tetuan, which is little more than a straight stretch of coastline between Cape Magari on the south and Cape Negro, or Negrete, on the north, despite the appearance of indentation due to the prominence of these headlands. Looking northward from Cape Negro, the most notable object on the horizon is Jebel Musa, which, though situated on the Straits of Gibraltar, towers above the intervening hills.

The Bay of Tetuan being, in fact, merely an open roadstead with a very prevalent wind from the east, termed the Levante, shelter therein is not particularly good and anchorage is poor. The best of it lies in a depth of 14 fathoms. The so-called port possesses neither docks nor quays, so that cargoes have to be transported ashore by means of open boats, which are loaded overside from the vessels in the bay. Operations, therefore, are dependent on favourable weather conditions.

Trade

The trade of Tetuan is mainly carried on by Jews, and comprises fruit, wool, silk, girdles, leather and cotton goods. There is export of provisions largely to Ceuta and the neighbourhood. Skins, wax, almonds, oranges and eggs are other commodities handled, and there is also some amount of trade in cattle.

Note.—The plan of Ceuta Harbour on page 5 is based upon a British Admiralty Chart, with the permission of H.M. Stationery Office and the Hydrographer of the Navy.

The fact that goods made of raw materials in short supply owing to war conditions are advertised in this Journal should not be taken as an indication that they are necessarily available for export.

Coast Erosion

The General Question of Coast Erosion and Measures Desirable for Prevention of Damage caused thereby; and the Drainage of Low-lying Lands*

By T. B. KEAY, A.M.Inst.C.E., A.M.Inst.M. & Cy.E.

(Concluded from page 245)

THE DRAINAGE OF LOW-LYING LANDS

Introduction

The drainage of low-lying lands and, equally important, their protection against floods such as illustrated in Figure 12, and against sea inundation, is perhaps the most difficult of all land drainage problems, and one to which attention has been given since the earliest day of English history, a great amount of work having been carried out by the Romans, some of which is still traceable.

The first recorded endeavour was in 1225 when Henry III constituted by Charter a body of persons to deal with the question.

The low-lands, being mainly comprised of recently-deposited alluvial material brought down by rivers or carried by the sea, are exceedingly fertile and it is chiefly in order to convert them into rich agricultural land that land drainage works are undertaken. This conversion is achieved by draining the excess water, which tends to be injurious to man, animals, crops and plants, either direct into the sea or into a tidal river.

Fig. 12. Example of Flooding of Low-lying Land.

Main Principles

Low-lying lands (i.e., lands approximately at sea level) are traversed by the upland rivers which have played a part in their formation and unless the land immediately adjoins the coast, it is these rivers which are used for their drainage.

The river levels may be anything up to 15-ft. to 20-ft. above the adjoining land so that the first requirement is to make the rivers capable of conveying all upland waters, as well as the water from the lowlands themselves, along to the sea as speedily as possible and without causing flooding. This is achieved by grading and conditioning throughout, embanking where necessary, and what is most important, providing an adequate outfall.

Grading and Conditioning.—Serious obstruction to flow is caused by a meandering river and, together with growths, mills, weirs, locks, culverts and bridges, the impediment becomes such that flooding occurs.

By the removal of mud and silt, weeds, trees, bushes, islands, etc., and the straightening of the river by cutting off where possible all serious bends, as well as widening, deepening and regrading to obtain the maximum amount of fall, great improvements are brought about, but the work is expensive. The most effective of these is widening and deepening; care must be exercised to avoid removing the river bed down to a porous bottom.

Embankments.—These are called "barrier banks" and are necessary, especially in the tidal portions of the river to prevent overflow and consequent flooding. They should be high enough to contain the highest tide or the greatest flood or the conditions obtaining when the two occur simultaneously, and they must be sufficiently strong to resist the subsequent great pressure.

Embankments should be sited well back from the river as shown in Figure 13, to provide for a greater capacity in time of flood; this also affords a firmer foundation for the bank and protection is given to the toe by silt deposited during floods. They should be wide, both at the top as well as the bottom, and may have side slopes of 3 to 1 with a ditch on the land side; loose soil and dredgings may be used in their construction but clay is preferable if available; the slopes should be sown or turfed and trees prohibited on the banks. Where the bank is washed by the tide it should be protected by pitched or concrete revetment and this should apply to the reaches of rivers flowing through towns. Banks should be designed with a wide margin of safety to allow for settlement and also for the shrinkage of the land behind when drained.

Outfall.—The drainage of the whole area depends upon the efficiency of the river outfall, which, if tortuous or obstructed with shoals, reduces the discharge enormously.

Outfalls should be straight and clear and where necessary training walls may be constructed to form a permanent channel which the natural forces of tide and river flood discharge will maintain free from deposits.

Having fitted the rivers for their work of main carriers, the next point in the drainage of the lowlands is the provision of "catch-water" drains to intercept the rainfall from the surrounding higher land and convey it direct to the river; under no circumstances must it be allowed to flow on to the lowlands to overburden the lowland drains.

Drainage Methods Between Barrier Banks

The drainage of the land which lies between the barrier banks that confine the upland rivers and conduct them to their outfall, is effected by a complex system of open ditches, small drains and larger main drains, sometimes combined with under-drainage of the ground itself.

The main drains discharge into the upland rivers, the method adopted for this depending primarily upon the situation and level of the area under consideration, there being three chief methods, viz.: (1) drainage by gravitation, (2) lifting the water by pumping, and (3) the combination of the first two.

The difficulty of the problem is increased by the fact that these low-lying lands shrink at

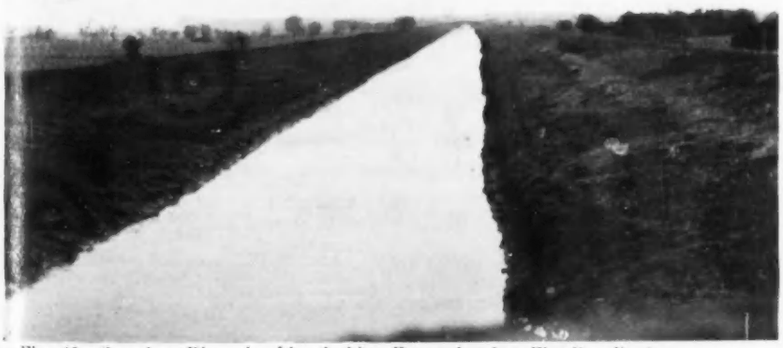


Fig. 13. Steeping River in Lincolnshire Fens, showing Flooding Banks.

*Paper read before the Institution of Municipal and County Engineers and reproduced by permission.

Coast Erosion—continued

Fig. 14. Small Pumping Station on Steeping River—Main River Bank in Background.

an estimated rate of ½-in. per annum owing to the abstraction of water from the peat; this causes reduction in velocity of rivers with an increased tendency for outfalls to silt up; further, many areas originally drained by gravitation shrink to a level which makes this impossible, and pumping becomes imperative.

Drainage by Gravitation.—This affords the simplest and most effective method wherever practicable. The main drain discharges by gravitation into the river through sluice gates when the tide falls sufficiently, a rising tide automatically closing the gates and so preventing ingress of water. The dykes and drains must therefore have reservoir capacity sufficient for the storage of the maximum amount of flood water which can accumulate while the gates are closed. It has been recommended that the discharge capacity of main drains should be 1 per cent. of the annual rainfall, in 24 hours.

Sluices, best sited at a concave bend in the river, should discharge in the direction of the ebb flow at as small an angle as possible; place the doors on the river side of the structure and avoid silting of the channel between the doors and the river by allowing as much fall as possible.

Syphons have been used in the past instead of sluices but these are not really practicable owing to the loss of head and the cost of operation.

Discharge by Pumping.—Where, owing to adverse levels, gravitation drainage is impossible, the water must be pumped into the river. See Figure 14. This method has the advantage of being independent of the state of the tide.

The older pumping appliances, such as windmills and scoop wheels, screw and bucket pumps were first replaced by compound steam engines coupled to centrifugal pumps but these pumps are nowadays operated by gas or oil engines, or where cheap enough, by electricity.

Discharge by Gravitation Assisted by Pumping.—In many cases where gravitation drainage is possible at low tide but the reservoir capacity is not great enough to store all the water collecting behind the sluices while closed, it is found more economical to augment the storage by the installation of pumps which enable discharge over a longer period, than to increase the reservoir capacity by raising the drain banks. It is not economical to lift the water to discharge against high tide so the storage capacity is utilised during these periods.

Where it is possible to use any of the above methods the deciding factor is cost, gravitation drainage being the cheapest unless the annual loan charges for this method exceed the average annual cost of a pumping station.

Discharge Direct to Sea.—Where a narrow strip of low-lying land lies along the seaboard, as for example the Lincolnshire Coast, it may be drained by dykes and drains with occasional outlets by sluices into the sea. The sluice should be sited in a sheltered position and it is often necessary to carry the outfall some distance from the shore to avoid siltation. Storage capacity during high tides may be increased by the provision of basins such as is shown in Figure 15.

Maintenance and Flood Prevention

Fen drainage is never completed, the key to the problem being the efficient maintenance of the whole system; watercourses must be kept cleaned and free from obstructions; embankments maintained, according special attention to the burrowing of moles, voles, rats, rabbits, etc.; and sandhills or other sea defences where protecting the land from inundation must be rigorously guarded.

Advantage should also be taken of the Town and Country Planning Act, 1932, to restrict or prohibit building operations on land liable to flooding.

Drainage Law

Before 1930, comprehensive works on the main rivers were, for the most part, impossible, because generally different lengths of river were administered by different authorities, or else the banks were repairable by private owners. In 1930, however, after the Report of a Royal Commission, a new Land Drainage Act was passed repealing, amending and consolidating previous Acts. This Act places full and sole control of a main river, its banks and tributaries, under a catchment board and creates drainage districts either within or without the catchment area.

Thus one authority is now responsible for the whole of the main river, which is a great improvement.

The expenses of a catchment board are met by Government Grants and by precepts upon authorities within the area.

Conclusion

The responsibility for the drainage of low-lying lands rests with the local administration, assisted by Government Grants, but the floods which frequently occur prove that, while much is being done (£4,870,000 having been expended between 1921 and 1930), local resources cannot adequately solve the problem.

The realisation that 1,755,000 acres of rich alluvial land in England is subject to flooding or requires draining, and that the subsequent annual loss to the nation in food alone is £18,000,000, together with the restriction of food imports which would occur in times of war, is surely a matter for grave concern.

In the Author's opinion, the Government should take the initiative in the protection of these vital food-producing areas and thus strengthen national defence.

At the same time water conservation methods might be improved to end the ridiculous paradox by which farmers have to take to boats in winter and watch their crops destroyed by drought in summer.

Trade at Californian Ports.

The total weight of cargo handled over the piers, excluding those assigned to the Army and Navy, at the port of San Francisco during the fiscal year ended 30th June, is stated in a report by the State Harbour Board to have been 7,447,369 tons, as compared with 7,118,568 tons in the previous year. At the port of Los Angeles, the total weight of cargo handled during the fiscal year was 19,931,075 tons, as compared with 18,327,890 tons in the previous year.

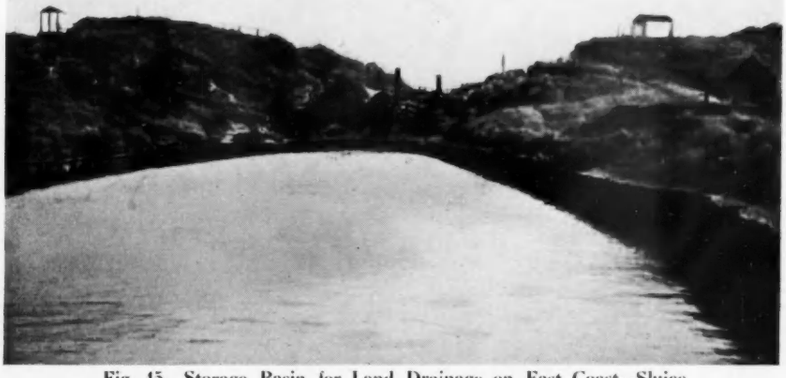


Fig. 15. Storage Basin for Land Drainage on East Coast—Sluice and Sand Dunes in Background.

Circular Track Yacht Slipway

An Interesting Installation at Miami

The Miami Shipbuilding Corporation at Miami, Florida, U.S.A., have installed at their works a novel "swing-transfer table" in connection with a new 100-ton yacht slipway. This unique swing-transfer unit, for which patent application has been made, consists of a car which can turn through 90 degrees and then traverse in a straight line any desired distance to coincide with this section of the yard tracks which run parallel to the river.

Thus, to place a boat in the shop or storage, it is hauled out on the 100-ton yacht slipway, grounded on a transfer cradle previously run on to the longitudinal rails. When the 100-ton cradle is in the upper position, the transfer cradle, with the boat on it, is pulled ahead on to the swing car. The swing car is turned 90 degrees and then hauled back until it abuts the desired yard track, when the transfer cradle and boat are pulled off into position. This entire operation, from afloat to final position, requires about thirty minutes. The procedure is reversed for launching.

Due to having acquired property adjacent to their yard but back and parallel to the Miami River, the company desired to make use of this space for the construction of and repairs to motor patrol boats, yachts and other similar craft. After a considerable study it was decided to install a 100-ton slipway and a special 50-ton swing-turn and transfer table to permit craft to be hauled out longitudinally, pulled ahead into the yard, turned at right angles and moved into any desired berth.

To accomplish this interesting innovation an old marine slipway was torn out and the new 100-ton yacht slipway with the following dimensions was installed:—

Length over keel blocks	72	feet
Width over cross beams	24	feet
Depth of water over beams at mean low water, forward	9.5	feet
Depth of water over beams at mean low water, aft	12	feet

The tracks are of the two-way type with the portion above water of reinforced concrete and the submerged portion of wood, protected against marine borers, and supported on concrete piers resting on the rock bottom. They are constructed on an arc of a circle, so designed that the top of the cradle is horizontal when in the upper position, and providing the stated depths of water when in this upper position, and also providing the stated depths of water when the cradle is fully submerged.

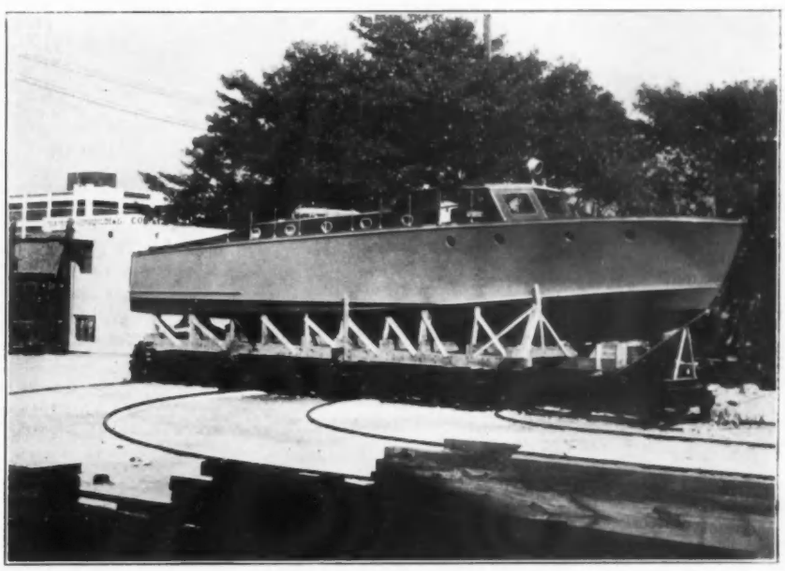
The cradle is constructed of wood, with the slope of the line of the beams independent of the slope of the tracks. It is equipped with ten sliding bilge blocks operated from the docking platforms, the latter being supported by uprights fastened to extremities of the transverse beams.

The bottom chords of the cradle are equipped with truck wheels running on railroad rails fastened to the track. The cradle is hauled by a single, welded iron hauling chain connected, on an endless system, to a smaller backing chain operated by an electric hauling machine.

The top of the cradle is provided with two heavy railroad rails for supporting the transfer cars. Thus, when in its upper position the railroad rails on top of the cradle coincide with similar tracks in the yard which extend to the swing-transfer table.

Recently completed and now in successful use, this yacht slipway and transfer system was designed and its construction supervised by Crandall Dry Dock Engineers, Cambridge, Massachusetts, to whom we are indebted for the description and photographs.

Aerial View of Slipway for Yachts at Miami



Yacht on Cradle, showing Circular Track.

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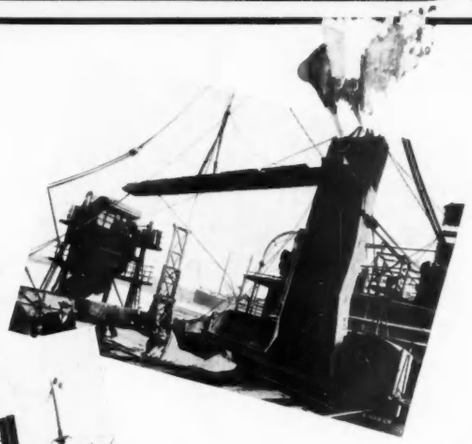

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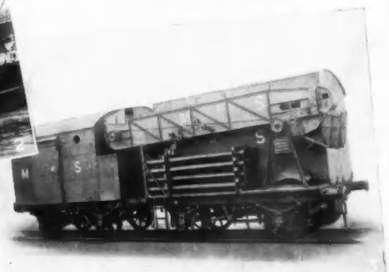

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